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LOCATION OF THE SERVICE CUTOUT.

The Code rule that on all service wires a cutout consisting either of a fuse or a circuit-breaker must be placed at the nearest readily accessible place to the point where the wires enter the building is a somewhat elastic requirement, in that it leaves the quantity "nearest accessible" to be defined for each individual installation. It appears, however, that since the service cutout is to be placed inside the building, the rule could scarcely be made less flexible than it is without inviting, or indeed making necessary, its frequent violation. The Code, of course, contemplates the installation of the cutout at the immediate point where the wires reach the interior, in all possible cases; but it wisely recognizes the fact that in wiring practice, conditions are sometimes such that to place the cutout here would necessitate an expense not warranted by any fire hazard arising from its location at some more convenient point.

Undoubtedly, however, there is a tendency in some localities, either deliberate or else resulting from ignorance of the best practice, to take undue advantage of the latitude allowed in the matter and to violate the real spirit of the rule referred to. This is particularly true in residence wiring in towns not having systematic provisions for the inspection of all wiring before the service is connected. Here one may often find a run of many feet of open wiring or of concealed knob-and-tube work between the first cutout and the point where the wires come through the wall.

That such construction as this is extremely faulty becomes apparent upon very slight consideration. It usually means that a portion of the circuit within the building is left without any fuse protection whatsoever, other than that afforded by fuses at the transformer or substation; and the carrying capacity of these fuses may be many times that of the wires in the circuit in question. Even when the wires between the point of entrance and the main cutout are run in conduit, as they should always be, of course, this absence of fuse protection for that part of the circuit may prove objectionable. As substantial as it is, the conduit-clad circuit is not immune from injury, and it is rarely certain that abuse of the circuit either during its installation or thereafter may not result in the breaking down of the insulation of the wires, with a disastrous short-circuit which must necessarily follow. In fact, a number of cases of this kind have been reported lately. Not long ago there came a report from an electrical engineer of an inspection board in the West, in which it was stated

that several very destructive fires in that section had apparently originated from faults in runs of conduit between service entrances and service cutouts. This sort of trouble had assumed such proportions, it was stated, that the inspection board was seriously considering requiring that where the cutout could not be located inside the building immediately at the point of entrance, one must be installed on the outside. Another similar report, coming from a correspondent in Toronto, where the fire to which this latter correspondent refers occurred, appears in another section of this issue; and it seems that in that locality the precautionary measure contemplated by the western inspectors is actually to be put into operation.

So far as the data supplied in the report go, it appears that in the Toronto installation a cutout might easily have been located in the basement where the circuit came through the wall, and that in the judgment of the inspector a cutout should have been placed either here or on the outside. However, since the distance to a more convenient location was but seven feet, the inspector was prevailed upon to allow a continuous run of conduit from the outside of the building to this point. It may be added further that there seems to be no reason why the circuit, if it had been accorded the proper sort of treatment, should not have proved entirely safe and have remained permanently so. The breakdown must certainly have been due either to the effect of the heat from the steam pipe which was installed after the wiring was finished, or from some other unnecessary abuse of the circuit.

Conditions leading to results such as those just enumerated do, without doubt, demand attention. There is much room for doubt, however, as to whether anything like a general adoption of the practice of installing cutouts on the outside of the building in cases of the kind under consideration would prove the most practicable and effective remedy for the disorder complained of. As a matter of fact, there are engineers of wide experience in such matters who do not consider it practicable to install the service cutout on the outside of the building in overhead distribution. There are other means which might certainly be employed to improve present conditions greatly, if not indeed to remove the trouble altogether. These, it would seem, might be found in the location of the cutout inside the building just where the wires enter in every practicable case, instead of at some point thought to be the nearest accessible one; the use of conduit properly installed between the entrance and the cutout whenever it is impossible to locate the cutout at the entrance; and in more frequent subsequent inspections, made in order to insure that the circuit is not treated in such a way as to make probable a breakdown of the insulation of the conductors within the conduit. Thus any apparent need of fuses on the outside could probably be largely removed.

COOKING BY ELECTRICITY.

There should no longer be any question about the success of cooking by means of electricity wherever a reasonable rate can be secured for this kind of service. While a number of successful attempts at cooking on a large scale have been made in this country, the matter is not being pushed to the extent it deserves by the central-station companies. In the hands of the latter the widespread adoption of electric cooking lies, because the whole question is merely one of a suitable rate, and since the load is largely an off-peak one, this rate can with advantage be made in almost every locality. From the standpoint of satisfactory operation and achievement of desirable culinary results, nothing remains to be desired. The best cooking of many substances requires a comparatively low temperature and the electric oven is peculiarly fitted to supply this. The result is that the volatile portions of the food are not so completely driven off, thus attaining a greater weight and a finer flavor of the finished product. This not only affects the desirability of the prepared food but has an appreciable effect upon the bill for supplies.

The problem is, therefore, in every case only a commercial one, but just what rate fixes the commercial limit is not as yet established and probably varies under the different conditions to be found in different communities. It has been demonstrated, however, that certain rates will actually lead to a saving in the cost of heat. Upon another page of this issue will be found an account of a large electric kitchen which has been recently established in London, England, upon a commercial basis and is giving very satisfactory results. In this case the charge is two cents per kilowatt-hour, and a saving in the cost of fuel has been noted. Certainly wherever a rate as low as this can be secured there should be no question about the financial advantage in using the electric method, and under some circumstances even a higher rate would be found more economical than the use of coal or gas.

The manufacturers are doing their part in putting upon the market electric stoves and other utensils which are well adapted for carrying on almost every kitchen operation, and the fate of this application of electricity seems now to rest in the hands of the central station. If the new-business department will apply the proper energy to this question, electric cooking should advance with great acceleration in this country. At present it appears that we are lagging behind our sister across the water in this particular development. England has great advantages in its density of population and its accessibility to cheap coal, in furnishing power at low rates, but there are many places in this country where conditions are equally satisfactory, not only in proximity to the coal fields, but in places where hydroelectric power is available. It should be quite possible for most of our central stations to offer special rates for this type of load, making restrictions if necessary upon the hours of use.

One particular field where the load would unquestionably be off the peak is in the typical lunch room of our large cities, where most of the cooking must be done in the forenoon. Many of these places are only open for the midday meal, and even where they are giving service for the entire 24 hours the great rush comes during the midday. These are, moreover, places to which electrical cooking is especially applicable, and their hours of maximum demand are certainly such as to earn an attractive rate. This business represents an opportunity which should not be neglected.

EXPERT TESTIMONY.

Expert testimony is frequently required in both civil and criminal cases in court where the matters in dispute involve technical knowledge such that a judge or jury is unable to determine merely from the testimony of eye witnesses what are the rights of the case. Engineers, as well as physicians, scientists, architects and members of other professions requiring expert knowledge are frequently called in in patent causes, damage suits and in various other types of cases. At present it is customary for either one of the parties to the litigation or trial to call in men who are supposedly experts in their profession to give testimony which will favor his own side of the case. It can be assumed that in all such cases the nature of the testimony to be given is arranged beforehand and neither side will call in as witness those whose testimony would be damaging to that side. It is obvious under such circumstances that the expert will be interested in one side of the case and will usually want to see that side win. He is, moreover, under obligations for witness fees, and perhaps otherwise, to the party who has called him into the case. Under such circumstances it is almost impossible to secure unbiased evidence and it may be stated as a matter of fact that such witnesses often deliberately withhold evidence which would damage their side of the case and seek to disclose only such facts as will be an aid in winning the case. The testimony as introduced is not full and free; it is not given for the purpose of obtaining the truth and promoting justice, but rather with the prime object of helping one side to win regardless of the merits of the case. Indeed in some quarters the reputation of those who are habitually called into court as experts is not of the highest, with the result that men of high standing in the profession are rather averse to serving in this capacity, and the testimony of really conscientious men is not sought.

When we consider that the prime object in establishing courts to decide matters at issue is to arrive at the truth and promote justice, it seems strange that such a course of procedure should have grown up in our courts. With most questions of evidence, personal knowledge of the facts involved is necessary to qualify as a witness. It seems evident then that the proper function of one with expert knowledge should be to act as an advisor to the court in somewhat the same relation as a master in chancery, rather than to appear as an advocate for one side or the other. It would seem desirable then that experts should be called in to help the decision of legal cases without previous knowledge as to what their testimony or opinion of the matters involved will be, and that they should be selected solely on their standing in the profession and their reputation for an intimate acquaintance with the subject under consideration. Under such circumstances an expert could be expected to investigate fully the circumstances of a particular case and give fully and freely of his knowledge and rich experience in aiding the judge and jury to form a correct estimate of the questions under consideration.

It is generally true that even among conscientious and well informed members of any profession differences of opinion will exist in regard to any question which may be at all debatable, and it is nearly always possible for a litigant to call in some expert whose views in the matter will favor his side of the case. When to this condition is added the fact that some unscrupulous men are to be found in almost every profession, the present situation is surely one to be deplored.

A movement is on foot in several quarters to change judicial procedure in this particular. The matter is as vital to engineers as to any other class of experts and they should unite in doing what lies within their power to correct the present abuse of expert testimony. Action on the matter by engineering societies and similar bodies will tend to bring the matter more fully to the attention of the public and will have great weight with legislators and others who have it within their power to bring about a change.

LARGE TURBINE UNITS.

It is not long since the installation of turbogenerator units of 20,000-kilowatts capacity in the Riverside Station of the New York Edison Company and in the Northwest Station of the Commonwealth Edison Company, Chicago, elicited much attention and comment on account of their size, which was the largest ever yet constructed in the world.

Recently, however, orders have been placed by two different concerns for turbogenerator units which will equal or exceed these in normal capacity. One of these is to be built in this country by the Westinghouse companies for the Brooklyn railways, and will have a capacity of 20,000 kilowatts. The Commonwealth Edison Company has placed an order in England for a turbogenerator of 40,000 horsepower. Sir Charles A. Parsons, the noted English authority on steam turbines, is giving personal attention to the design and construction of this unit, which will establish a world's record in the capacity of the steam-turbine unit.

March Meetings of the Philadelphia Electric Company Section.

On March 1, the Meter Department Branch papers were well prepared. H. Carl Albrecht of the Alternating-Current distribution department, taking up the subject of "Voltage Regulation," went into the detail and operation of many types, showing the advantages and disadvantages of types and their application to particular systems. Lantern slides were used in showing the regular equipment in various generating and substations.

N. E. Funk, of the generating department, presented the second paper, covering the subject of "Relations and Calculations of Voltages in Two-Phase Three-Wire Systems." Mr. Funk made a very clear explanation of the dephasing action of the "B" wire in a two-phase three-wire system, and the manner in which this action produces a distortion in phase relation, with the resultant unbalancing of voltages in the respective phases.

Both papers indicated much original research work on the part of the speakers.

The Accounting Department Branch met on March 12, and the subject of the paper read by R. A. Huebner was "Costs as the Basis of Efficiency." It was a thoughtfully prepared paper and was well discussed.

The Commercial Department meeting on March 25 was well attended. A. C. F. Keleher, of the Holophane Company, gave a most helpful talk to the members on "Salesmanship." M. Keleher possesses the faculty of imparting the enthusiasm that has brought personal success to his audience, and after contact with Mr. Keleher the half-hearted salesman either goes out and gets business or gives up his job.

The General Section meeting on March 18 was a gala night. J. J. Carty, chief engineer of the American Telegraph, Telephone and Cable Company, presented a most interesting paper on "Philadelphia and the Development of the Telephone Art." Mr. Carty called attention to some very interesting historical facts in connection with the present development of the telephone, and the encouragement that has been given to this development by various scientific organizations of that city. The present status of the art was most entertainingly gone into by Mr. Carty, particularly in reference to the marvelous work that has been accomplished in permanently assuring communication between the large cities of the Atlantic coast, through the introduction of the Boston-to-Washington underground system. Mr. Carty also made clear to the audience the latter-day discovery of the possibilities of using the same circuits for telephone and for telegraph service. The phantom circuit was also explained in an interesting manner. The attendance of 450 was the largest of the season.

Program for Electrochemical Convention.

The spring meeting of the American Electrochemical Society will be held in Boston, Mass., April 18, 19 and 20. Headquarters will be at the Hotel Lenox. Trips have been arranged to the electric steel furnace at Worcester, to the Norton Emery Works, to the Lynn works of the General Electric Company, and to Lexington and Concord, the latter to be by automobile.

Sessions for the reading of papers will be held on Thursday morning, Friday morning and Saturday morning. On Thursday evening there will be an illustrated lecture by Professor Cross on "Conduction Through Gases."

At the session on Friday morning there will be a symposium on "Electric Conduction." At the other sessions the following papers will be presented: "The Effect of Addition Substances in Lead-Plating Baths," by F. C. Mathers and O. R. Overman; "Uniformity and Simplicity in Electrochemical Calculations," by Carl Hering; "Effects of the Variations of Thermal Resistivities with the Temperature," by Carl Hering; "Experiments on Heat Insulation," by F. A. J. Fitzgerald; "An Electrolytic Method for the Reduction of Blue Powder," by Warren F. Bleecker; "Tensile Strength of Electrolytic Copper on a Rotating Cathode," by C. W. Bennett; "The Regeneration of Sulphated Storage Cells," by C. W. Bennett and D. S. Cole; "A Rotating Cathode," by C. W. Bennett; "Electrical Endosmose," by W. D. Bancroft; "On the Nature of Zinc Cementizing (Sherardizing)," by Arden R. Johnson and Willis R. Woolrich; "Smee's Theory of Electrolytic Deposits," by W. D. Bancroft; "Power Supply to Electric Furnaces for Refining Iron and Steel," by W. Sykes; "Furnace Electrodes Practically Considered," by R. Turnbull; "On the Volatility of Zinc Oxide," by O. L. Kowalke; "High-Tension Equipment for Electrometallurgical Plants," by J. R. Wilson; "The Influence or Diffusion on the Electromotive Force Produced in Solutions by Centrifugal Action," by W. Lash Miller; "Vacuum-Furnace Metallurgy," by C. G. Fink; "Temperatures of the Carborundum Furnace," by L. E. Saunders; "Gas Circulation in Electrical Reduction Furnaces," by J. W. Richards; "Potential Differences at the Junction of Unmiscible Phases," by R. Beuther; "Performance of Dry Cells," by C. Hambuechen; "Report of the Committee on Dry-Cell Tests."

The New York Electrical Society.

The 309th meeting of the New York Electrical Society was held at the Engineering Societies Building, March 28, 1912. William Benham Snow lectured on "The Uses of Electricity in Medicine and Surgery, in Accordance with Modern Standards: with Demonstrations and Exhibitions of Apparatus." The lecture was extremely interesting and was illustrated with demonstrations of the roentgen ray, with lantern slides showing results of treatment. There was an excellent exhibition of apparatus illustrating many of the latest developments in electrotheraphy.

The following life members were elected: Emil Heuel, Michael I. Pupin, Ernst Woltmann, S. N. Castle.

The April meeting is fixed for the seventeenth instant, when Guglielmo Marconi will address the Society on the latest developments in wireless telegraphy.

Jovian Rejuvenation at Fort Wayne.

A rejuvenation of the Sons of Jove was held at Fort Wayne, Ind., under the direction of Statesman A. A. Serva, on Wednesday, March 27, when a class of 38 was initiated. In this connection a local Jovian league was also formed. The degree team was as follows:

Jupiter, Samuel A. Hobson, St. Louis.
Neptune, A. A. Serva, Fort Wayne.
Pluto, E. D. McKellar, New Orleans.
Mars, E. A. Wagner, Fort Wayne.
Apollo, J. C. Lott, New York.
Hercules, J. C. Moulton, New York.
Vulcan, O. F. Allen, New York.
Mercury, A. H. Boyd, New York.
Aurenim, A. L. Pond, Chicago.

At the banquet, at which 60 covers were laid, preceding the initiation, addresses were made by S. A. Hobson, on "Jovianism;" F. S. Hunting, "Co-operation;" O. N. Guldin, "Memories;" A. A. Gray, "The Press;" and by T. A. Ryan, for the candidates.

New York Entertainment Meeting.

The New York Companies Section of the National Electric Light Association will hold an entertainment meeting at the Edison Auditorium in New York City on the evening of April 15. Two illustrated lectures will be given. Frederick Monsen will speak on "The Panama Canal;" Augustus Post, secretary of the Aero Club of America, will speak on "Navigation in the Air." A musical program will complete the evening's entertainment. Refreshments will be served and section officers will be elected. All Class E members living in the vicinity of New York are members of this section, according to the recent ruling of the National Committee, and they are cordially invited to attend the meeting.

Dana Pierce.

There is probably no one institution in the country having greater authority in the field of applied electricity, nor withal of greater value and importance to the electrical industry as a whole, than are the Underwriters' Laboratories. To them are submitted for examination and for approval or criticism most electrical appliances intended for service of such a kind that the use of apparatus of improper design or faulty construction would introduce a fire risk. Approval is taken by insurance companies and electrical inspectors the country over to mean that the appliance approved may be employed without risk or hazard. Moreover, examinations are so thorough and decisions so just that manufacturers usually accept them without question or comment. Thus the Underwriters' Laboratories serve in a kind of electrical-engineering capacity for the entire country.

As already suggested, however, the prestige of this institution has grown out of no legal statutes. The function of the Laboratories is simply to make recommendations. That these recommendations are incorporated by others into ordinances is only because they have been found to be uniformly wise and safe. They possess these qualities largely because of the technical skill and good judgment of the men who make them. The man who for the past seven years has directed this important electrical work is Dana Pierce, whose position is that of electrical engineer for the Underwriters' Laboratories.

Dana Pierce,
Electrical Engineer, Underwriters' Laboratories.

Aside from his skill along electrical lines, Mr. Pierce's training and experience have been such as to make him a man of unusual breadth of culture. Born in Claremont, N. H., in 1871, he received a preparatory education in the schools of Newton, Mass. He entered Amherst College in 1888, and was graduated from this institution four years later. Here he was a member of the Theta Delta Chi and Phi Beta Kappa fraternities, and took a lively interest in all matters pertaining to student life. In his studies he made a specialty of the classics and other literary branches. After completing his course at Amherst he went to the Hotchkiss School, at Lakeville, Conn., where for a time he taught languages and mathematics. During this period he became interested in scientific and technical subjects, particularly in physics, and began a special study of that subject, attending lectures, whenever occasion would permit, both at Harvard and Cornell. In 1899 he entered Johns Hopkins University as a special student in physics and mathematics, and after a year in this institution he accepted a position as a teacher of the former subject in Pratt Institute, Brooklyn, N. Y. Here he availed himself of the opportunities which this school affords for further specialization along technical lines.

After five years of work at Pratt Institute, Mr. Pierce resigned to accept his present position in the Underwriters' Laboratories. Since then the multitudinous electric-lighting and wiring fittings and supplies, together with the numerous industrial and domestic appliances for use on the electric circuit, which pass constantly through the Laboratories, are all examined and tested and reports upon them prepared under his personal direction and supervision.

In the course of his experience as a teacher and an engineer, Mr. Pierce has found time to do noteworthy work along the lines of scientific and engineering literature. While teaching at Pratt Institute he assisted in the preparation of several textbooks in physics and elementary mechanics, and he has recently prepared a treatise on electrical construction which is published by one of the prominent trade and engineering schools and used as a text. This book was written with a special view to describing electric-wiring practice to conform to the requirements of the National Electrical Code. He is also a prominent worker in a number of leading technical societies to which he belongs. He frequently attends the conventions of these, where he is always an active and very influential participant in the discussions of matters pertaining to his own special field. Among other organizations, he is a member of the Electrical Committee of the National Fire Protection Association and of the Committee on Wiring Standards of the Commercial Section of the National Electric Light Association. He is also an associate of the American Institute of Electrical Engineers. Mr. Pierce resides at Kenilworth, Ill.

Program for Missouri Convention.

The sixth annual convention of the Missouri Electric, Gas, Street Railway & Waterworks Association will be held at the Connor Hotel, Joplin, Mo., April 11, 12 and 13.

Papers will be presented by R. A. McGregor on "Power Development of Lead and Zinc District in Southwest Missouri;" by F. N. Jewett on "Unity-Power-Factor Single-Phase Motor;" by Hugh Cooper on "Keokuk Power Development in Mississippi River;" by Herman H. Spohrer on "Electric Rates;" by H. B. Shaw on "Electric Pumping;" by P. W. Markham on "Lighting and Power in Rural Districts;" by J. Q. Day on "Liability Insurance;" and by P. A. Bertrand on "Soliciting New Business, Gas and Electric."

There will be executive sessions each morning and on Saturday afternoon. On Thursday evening there will be a rejuvenation of the Sons of Jove, and on Friday evening a banquet. On Friday afternoon a trip will be taken by special train to the power plant of the Empire District Electric Company, at Riverton, Kans. On Saturday morning there will be a trolley trip through the mining district, arranged by the Southwest Missouri Railway for the members and guests.

Plans for Des Moines Electric Show.

Plans are rapidly being completed for the electric show which is to be held under the auspices of the Des Moines Electric Company in the Coliseum, Des Moines, Ia., April 23 to 27. This show will be held in conjunction with the annual conventions of the Iowa Electrical Association and the Iowa Street and Interurban Railway Association, and many special features of interest to central stations, as well as the public, are being arranged for.

One feature will be the wireles telegraph exhibit of the United States Government. This will be a working exhibit and messages will be exchanged with other stations in the building.

Perhaps the most interesting feature of the show will be the domestic science exhibit of the Des Moines High School. Arrangements have been made to equip several booths with a complete installation of household electrical appliances and electric ranges and the school officials have agreed to conduct regular classes at the show, utilizing the equipment.

W. A. Willoughby, who is manager of the show, announces that all exhibit space has been contracted for and all indications point to a most successful exposition.

New 40,000-Horsepower Unit for Commonwealth Edison Company.

Charles A. Parsons & Company, Newcastle-on-Tyne, Eng., is building for the Commonwealth Edison Company, Chicago, a 25,000-kilowatt turbogenerator set for installation in the Edison Company's Fisk Street station. The maximum rating of the unit will be approximately 40,000 horsepower. The turbine will be a two-chamber horizontal machine, the low-pressure end being of the double-flow type. The dimensions of the unit are 75 feet long by 18 feet wide. The generator will be wound for 4,500 volts, three-phase, 25 cycles, and will have a speed of 750 revolutions per minute.

Present plans call for the installation, ultimately, of four of these units, which will bring the total generating capacity of the Fisk Street station up to 220,000 kilowatts.

An order for a steam turbine with a capacity of 20,000 kilowatts has been placed with the Westinghouse Machine Company. It will be direct-connected to a generator of equal capacity, which will be built by the Westinghouse Electric & Manufacturing Company. This will be the largest horizontal turbogenerator ever built in this country. It is to be used by the Brooklyn electric railways.

Louisville Lamp Situation.

Strenuous efforts on the part of the Louisville Electrical Contractors' Association to secure the consent of the lighting companies of that city to maintain retail list prices on lamps, fans and other current-consuming devices do not seem to have had any effect thus far, and two companies in the field, the Louisville Lighting Company and the Kentucky Electric Company, have recently made announcements to their customers of willingness to install lamps free or at cost prices.

A committee waited on the companies last week and asked them to give the dealers a chance to sell these goods at a profit. The Louisville Lighting Company expressed a willingness to do this, and even to close its display rooms entirely and put the business of selling electrical merchandise in the hands of the contractors and dealers altogether, if the competing company would make a similar agreement. This the Kentucky Electric Company declined to do, however, and the result is that the situation remains unchanged.

The Louisville Lighting Company announced that on and after April 1 it would install, on new business and renewals, Gem lamps free of charge. The Kentucky Electric Company followed this with a statement that it had been replacing burned-out lamps for both new and old customers with Gem lamps since March 1, and that it would from now on sell Mazda lamps at cost, this being a reduced price by virtue of a new contract made with the manufacturers.

Electric Drive for the Earth.

In the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN for December 2, 1911, page 1129, a description was given of a model which had been prepared to illustrate a theory intended to account for the rotation of the earth through the action of thermo-electric currents in a magnetic field. It was erroneously stated that the model there illustrated was prepared by Peter W. Sothman. While this model is in the possession of the latter, it is due to Albert Lotz, of Charlottenburg, Germany, who devised the theory and had the model constructed.

Direct Wireless Between New York and London.

It is said that the Marconi Wireless Telegraph Company contemplates the erection of high-powered wireless stations in the suburbs of New York and London for the direct transmission of wireless messages between the two cities. These are expected to be ready by January 1, 1913.

Indirect Lighting.

On March 28 the Nela Engineering Society, of Cleveland, O., had as its guests the members of the Cleveland Chapter of the American Institute of Architects and the Cleveland Architectural Club.

T. H. Aldrich, of the National X-Ray Reflector Company, of Chicago, delivered an illustrated lecture on "Indirect Lighting". A large number of lantern slides were shown, the majority of which showed installations of indirect illumination, which have proven their satisfactoriness in the city of Chicago. At the close of the lecture refreshments were served by the Engineering Department of the National Electric Lamp Association. The attendance was unusually large.

Illinois Tunnel Plant Sold.

The properties of the Illinois Tunnel Company, which owns the sixty-mile freight tunnel system and operates the automatic telephone system in Chicago, was sold at public auction on March 26. The price realized was $5,000,000. The purchase was made by a reorganization committee of the bond and stockholders. Officials of the company say that the sale will facilitate the reorganization of the allied companies on a sound financial basis. The Chicago Subway Company and the Chicago Warehouse & Terminal Company are involved in the transaction.

Cleveland Electrical League Luncheon.

Dayton C. Miller, professor in the Case School of Applied Science, spoke on the subject of "New Methods of Photographing Sound Waves" at a well attended noon luncheon of the Electrical League of Cleveland on March 29.

At the close of the meeting the question of organizing the Cleveland members of the Sons of Jove into a chapter whereby definite co-operative results would be accomplished was discussed at length.

Gift for Harvard Electrical Laboratory.

A gift of $50,000 to the Harvard Graduate School of Applied Science, consisting of a high-tension electrical laboratory, has been announced. It is intended to make the equipment of this laboratory the most up-to-date in existence. Among other items of the equipment will be a transformer delivering 1,000,000 volts and means for direct voltage up to 100,000 volts.

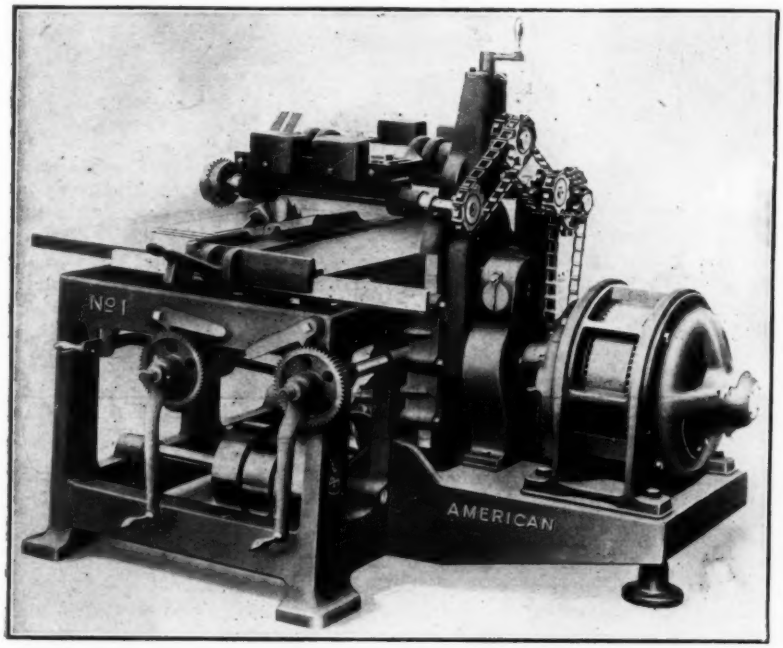
Nebraska Convention.

The annual convention of the Nebraska Electrical Association will be held at the Loyal Hotel, Omaha, April 16, 17 and 18.

Application of Electric Power in Woodworking Plants.

By H. O. Stewart.

One of the large items of expense in a woodworking plant is that of power. Yet it is often erroneously assumed that its unit of cost is very low on account of the wood waste available for fuel, and that consequently there is not the necessity for such economy as is practised in other industries. There is, however, no dodging the fact that lumber at $30 per thousand feet when used as fuel costs 30 times as much as coal at $3 a ton on a comparative basis of heat value.



Self-Feed Circular Rip Saw.

Value of Wood Waste.

Progressive managers, after careful study of this problem, have found that the amount of wood in the finished product is somewhere around 70 per cent of the lumber purchased, and that the wood waste can be sold in quantity at a price many times over its value as fuel. Soft-wood shavings are sold for bedding; hard-wood shavings for insulating purposes in cold-storage warehouses, for lining cars, for packing breakables and for various uses in nurseries. The blocks of wood are either glued together into heavy doors several inches thick for use in cold-storge plants, or are sold as kindling. Where wood waste is to be had in large quantities, alcohol, acetic acid, and even nutritious food for cattle have been manufactured from it by means of an ingenious mechanical process.

With the foregoing facts in mind it will be seen that with its comparative low fuel value as much of the waste as possible should be sold for purposes along the lines suggested. This has been done in many plants and the profit credited to raw material.

Choice of Drive.

A comparison of the necessary investment and operating cost under both conditions decides the question as to whether motor or line-shaft drive should be installed in a new factory. It will be found when woodworking machines are spread over considerable floor space, the investment in mechanical drive is greater than for motor drive, and, due to the high efficiency of motor drive, the operating cost is considerably less. Not only on account of decreased investment and lower power cost, but also on account of the many advantages inherent to motor drive, it has generally been found that motor drive should be installed in all new woodworking plants.

Our next consideration is the conversion from mechanical to motor drive. Here the situation is more complex requiring careful investigation of all the details entering into both systems of drive. The investment in shafting, clutches, pulleys, belts, etc., has already been made, likely at a cost equal or greater than that of the proposed motor drive. To decide whether the change is warranted a balance sheet should be prepared showing in detail each item involved in both types of drive. This balance sheet should include the actual cost of power for operating the machines, steam for kilns and heating, and the fixed charges and maintenance costs of the two types of drive. There should also be charged against motor drive the fixed charges on the mechanical drive to be discarded. There should be credited to the motor drive the increase in output due to better speed regulation as well as any other items which will increase the output. The completed balance sheet will show whether the proposed change is justifiable.

Importance of Speed Regulation.

The matter of speed regulation cannot be too thoroughly emphasized. Most plants employing mechanical drive suffer severely from poor speed regulation. The engine slows down under load and there is considerable slippage in each belt drive between engine and machine. It is not uncommon to find the machine at some distance from the engine running at 30 per cent less than its rated speed when the factory is carrying its average load. It is not feasible to speed this machine up 30 per cent as on light loads the speed would be so excessive as to cause rapid depreciation of the machine in question. As the output in the case of most wood-working machines is proportional to the speed, it is evident that motor drive would operate the machine at its maximum economical speed at all times, thereby increasing the output to what it should be. This is so important that the speed of each machine should be taken when the factory is running well loaded and when running light, and a comparison made with the speeds recommended by the builders of the machines. This data will serve as a basis for estimating the increase in output due to motor drive.

Determination of Energy Required.

The amount of energy required for motor drive is equal to the sum of the motor and wiring losses, the energy consumed in the mechanical connection between motor and machine, and the actual energy input to each machine. So much uncertainty attaches to the determination of the last-mentioned

item that a detailed explanation is in order.

The loss of energy in the mechanical drive due to friction is rarely ever known. The difference between the indicated horsepower of the engine when operating the factory with machines loaded and when operating with machines idle is commonly taken as the total friction load. As a matter of fact the friction losses increase with the load sometimes being three times, and usually at least twice, the no-load friction losses.

The friction losses under load conditions can be measured with considerable accuracy. In case central-station power is accessible the following method can be used to advantage. The mechanical drive should be sectionalized and each section driven temporarily with an electric motor. The number and location of these motors depend on the distribution of the load. If the factory is of considerable size, and possibly several floors, at least one motor per floor should be installed and should be located near the center of gravity of the load. It may be advisable to divide the line shaft into two or more sections on some floors, where the load is unusually heavy and is distributed on a long line shaft. The factory should be operated on these motors long enough to determine the average load on each motor, and then the machines should be disconnected from the line shaft and mechanical drive coupled up and driven by the engine. The motors, now running as generators, should be made to pump back into the electrical system carrying the same load which they did when running as motors. Due allowance should be made for the electrical and mechanical losses in the motors or generators. When the load is properly adjusted on each generator the engine should be indicated. The difference between the indicated horsepower and the generator inputs will equal the friction losses under the average factory conditions as previously determined. The total energy input to the woodworking machines will be equal to the difference between the indicated horsepower of the engine under average load and the friction loss at this same load.

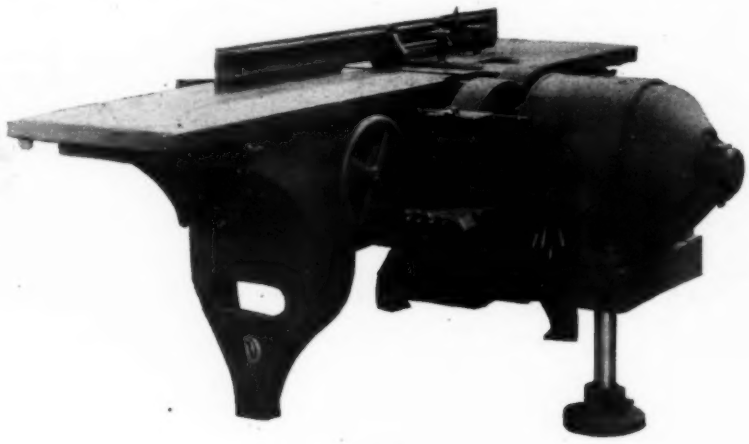
In making this test it is desirable to use direct-current motors as the load on such motors when running as generators can be readily varied with a field rheostat. Induction motors could be used, but when running as generators there would be some difficulty in adjusting their speeds so as to carry the load desired.

Choice of Power.

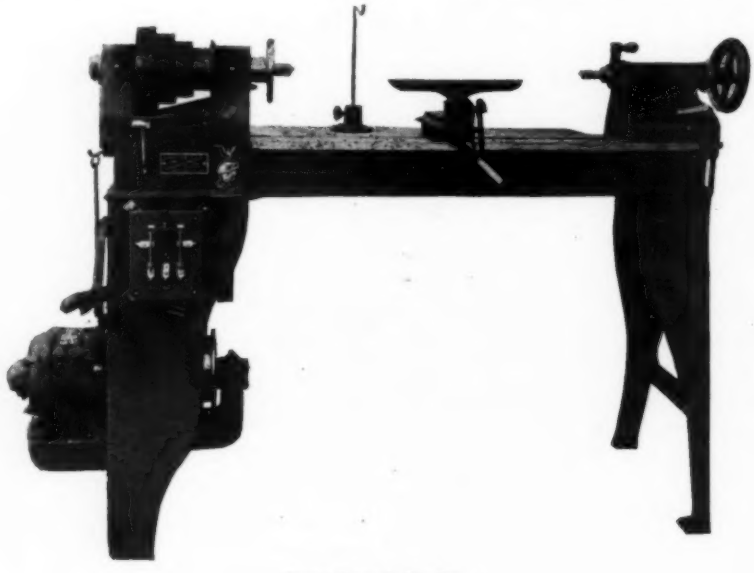
If the factory is to be operated on private-plant power, particular attention should be given to voltage regulation on account of the rapid fluctuating load characteristics of the average woodworking plants. The generating sets should have ample flywheel capacity, and it is advisable to use a Tirrill regulator on each generator. The dry kilns and as many heating devices as possible should be adopted to exhaust-steam heating.

The design of the kilns should be such that fresh air will be drawn in at the bottom of the kiln with a small motor-driven blower, uniformly circulated throughout the material to be dried, and discharged at the top after passing through a regenerator, which takes the heat out of the hot, moist air and gives it up to the fresh air entering the kiln. This method insures rapid and uniform drying of lumber at high steam economy.

Careful investigation of the cost of power for a number of new woodworking plants has shown that when there is a central station within reasonable transmission distance no saving would be effected by the installation of an isolated plant. On account of reliability, voltage regulation, variation in the demand for the finished product, future growth, large investment necessary, which could otherwise be put into the factory proper, it is often advisable to purchase power even at a somewhat higher cost than the estimated cost of generating power in the private plant.



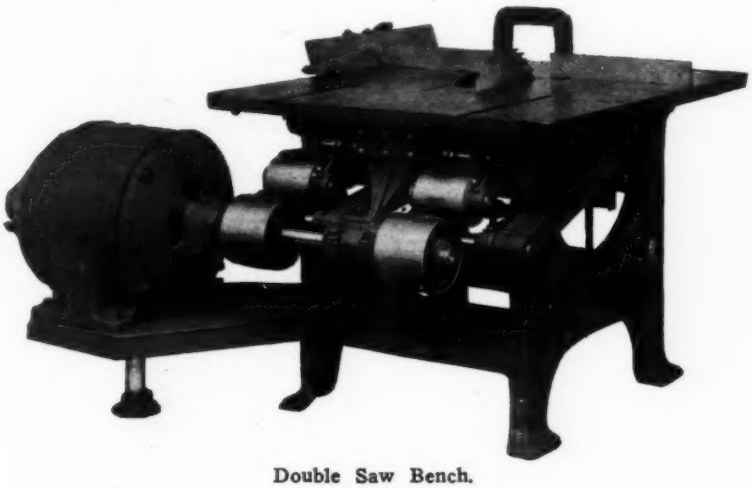
Jointer.



Four-Speed Lathe.

When the purchased power is decided upon the boiler plant should include automatic control for the boiler-feed and low and high-pressure steam alarm. That part of the wood refuse, which cannot be sold advantageously and is handled by the blower system, should be discharged directly onto the fire grates. Such a system will require

a minimum amount of attention. In one instance where such a steam plant was used it was found that the wood waste which was unsalable was of just sufficient quantity to furnish steam for all purposes. This boiler plant required practically not attention throughout the day.



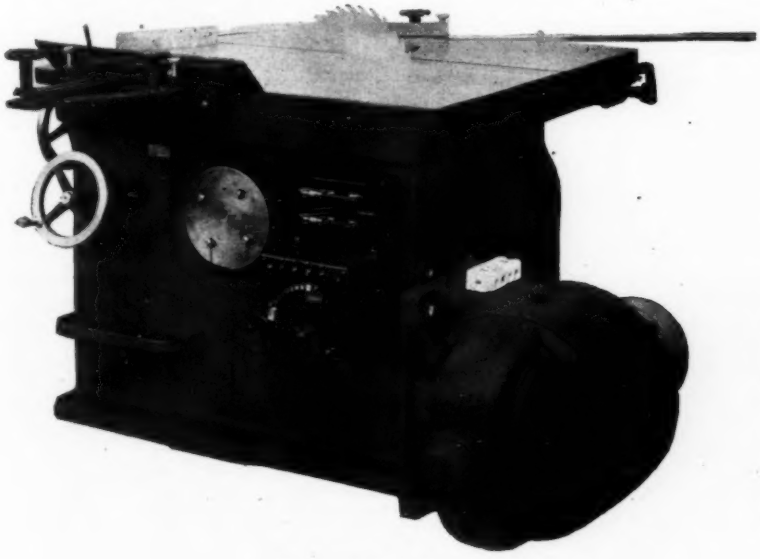
Double Saw Bench.

Advantages of Motor Drive.

Motor drive is of particularly great advantage to those plants where the output varies periodically. It should be kept in mind that when a small percentage of machines in a department are operated that the magnitude of the friction losses is many times that of the useful work, and that most of these losses would be eliminated by the use of motor drive. This is particularly true in overtime work.

A breakdown in the main part of the mechanical drive usually necessitates a complete shutdown of the factory. Trouble with motor drive is confined to one machine or to a group of machines.

Motor drive permits the most economical use of floor space. There is no need of a motor occupying floor space. On account of its compactness and smooth-running characteristics it may be mounted on the machine, placed under the machine, or attached to the wall or ceiling. The machines can all be located with regard to obtaining the maximum output, which can rarely be done when the machines must be driven from line shaft.



Universal Saw Bench.

In many woodworking plants the number of holes in the floor through which belts pass to drive separate machines on the floor above have increased the fire risk. In case of fire each opening becomes a chimney which fans the fire and carries it from floor to floor.

Experience has proven that motor drive has decreased the number of accidents. Direct-connected motors; elimination of belts passing through the floors; stopping the motor quickly from several places about the machines, which may be done with very simple and inexpensive control apparatus, have all contributed toward decreasing injuries to employes.

Choice of Motor.

It is evident that on account of the nature and characteristics of the manufacturing processes the induction motor is the most suitable for woodworking plants.

When accelerating machines have great inertia to overcome, such as heavy planers and matchers, as well as machines equipped with fly-wheels, such machines should be driven with motors having high-resistance rotors; the remainder should be driven with squirrel-cage induction motors.

Practically all woodworking machines, with the exception of lathes for special work, run at constant speed. The sparking of the direct-current motor makes this type of motor undesirable for this sort of work. Light weight, high-speed motors, involving lowest first cost, highest efficiency and power-factor are most desirable. The maintenance cost of this type of motor is somewhat less than for direct-current motors. The squirrel-cage type of motor should be used whenever possible.

Mechanical Connection Between Motor and Machine.

Improper mechanical connection between motor and machine or motor and countershaft has in some instances caused unjust criticism of motor drive. For direct connection a flexible coupling should be used unless motor and machine are mounted on a common metal bed plate or the motor is attached to the frame of the machine. Most manufacturers of modern woodworking machines have so designed them that they can be readily adapted to individual motor drive. Chain drive or heavy belt with a spring belt-tightener is desirable when the motor must be located close to the machine but cannot be direct connected. Fly-wheels should be used on motors driving machines which have only peak loads of short duration. With all belt drives a belt speed of from 4,000 to 5,000 feet per minute is most satisfactory and economical. Pulley ratios of more than five to one under ordinary conditions should be avoided when possible by using lower speed motors. When it is desired to install a motor on a machine having a speed several times greater than that of the motor, gear drives using steel-cut gears and raw-

hide or cloth pinions have been successfully employed.

Machine Layout.

To decide the question as to whether individual or group drive or a combination of the two should be adopted it is necessary to make a machine lay-out, placing each machine for the best routing of the material or partly finished article, so that it will get the best light possible, and so that a minimum amount of floor space will be required for the maximum output.

The most satisfactory way of doing this is to make a stiff-paper, scaled outline plan, together with some of the most important details, of each machine, and after cutting these out to place them on the floor plans so as to obtain the most favorable location of each. These "paper machines" can in turn be located by the manager of the plant, his superintendent, his foremen and the manufacturer of the machines. A final lay-out based on the preceding ones should then be drawn up.

The motor lay-out should now be made. From an inspection of the machine lay-out it will be evident that certain machines, on account of their location, must be driven by individual motors unless the routing, et cetera, as before mentioned be seriously impaired by grouping several machines so located on one machine. It is sometimes advantageous to belt two machines to one motor having a pulley on each end of its shaft. Those machines which are to be run intermittently or but a few days a month, as well as those machines which require large amounts of power and are scattered with reference to location, should generally have individual motor drive.

In the case of those machines operating continuously and which can be readily grouped so as to be driven by one motor, the type of drive should be selected on a comparative cost basis. If the total cost of power, maintenance, and the fixed charges on the individual drive is equal to or less than that for group drive individual drive should be selected. In considering group drive the maintenance and fixed charges on the mechanical drive should not be overlooked.

If the different machines in the abovementioned group are to be operated intermittently the shaft could be sectionalized by means of clutches. This would reduce some of the friction losses. It is likely, however, that on an economic basis individual motor drive should be chosen.

Selection of Motors.

The proper selection of the size and speed of the various motors is of the greatest importance and requires careful study. Each machine should be run at its maximum economical speed. The size of the motor will depend on the steadiness of the load, the speed of the feed, the kind of wood, as well as the peculiar design of the machine. A careful study of the accompanying data **(See Data Sheet No. 1.)** will bring out most of the above points, and will also furnish a basis and assist one's judgment in modifying other data to meet special conditions. Most tables give the power requirements of machines in first-class condition. The required amount of power will be increased on account of poor adjustment of machine or cutting tools, insufficient lubrication, dull tools, new and stiff machines.

It is evident from these data that the selection of a motor to drive a 30-inch double surfacer involves a consideration of the cylinder speed, rate of feed, kind of wood and width and depth of cut. Failure to consider any of these items might result in too small or too large a motor. Too small a motor would not permit of obtaining full output of the machine, while too large a motor means low efficiency and unnecessary investment. The data on the lathe, stave, sawing machine, scraper, and shaper bring out other items of importance.

Application of Fly Wheels.

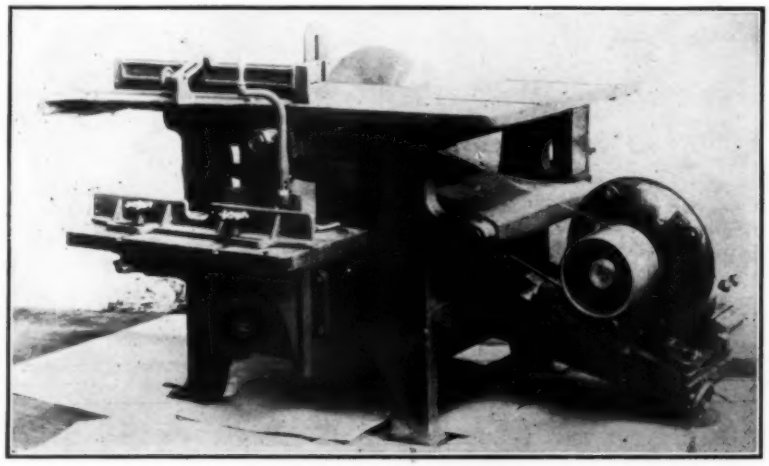
It is desirable with individual drive to equip with fly-wheels such motors as have peaks of short duration. In the design of a fly-wheel proper attention should be given to the maximum allowable speed variation of the machine. This varies greatly both with the kind of machine to which it is to be attached and the quality of work desired. For example, a 7-per-cent speed variation on a cross-cut saw performing high-grade work would be allowable and a 15-per-cent speed variation on average work. A 24-inch swing-saw will be considered as a concrete example of economy in the use of a fly-wheel. A 7.5-horsepower motor is direct-connected to the countershaft on the machine frame, which is belted to the saw arbor. This motor, running at 1,800 revolutions per minute, would cost $135. A 3-horsepower motor, costing $65, and equipped with a properly designed fly-wheel, would do the work equally well. The fly-wheel and its installation would not exceed $15 in cost. In addition to the saving in the cost of the motor and its installation over that of a larger motor, there is considerable reduction in the cost of wiring. Better voltage regulation also depends upon the use of fly-wheels.

Blower System.

Particular attention should be given to the blower system on account of its importance in taking away wood refuse from the machines, in keeping the air clean, and in its relation to the power costs. It is a fact often overlooked that on the thoroughness and rapidity with which the blower removes dust and chips from the surface being planed or sanded depends the quality of work turned out. The hood on each machine should be so designed for catching the wood refuse that the particles of wood when accelerated by the cutting tools will travel in the same direction as the blower is pulling. For sanitary reasons and for better illumination the amount of dust in the air should be kept at a minimum.

As the blower load is usually between 25 and 50 per cent of the total average load of the woodworking factory, considerable saving can be effected by a carefully designed system. It is the best practice to divide this load on several moderate-sized blowers rather than to have one large blower carry the entire load. The number and location of the blowers depend naturally on the load-factor and the size of each

(Continued on page 653)



Combination Saw Bench.

Woodworking Plants—Data Sheet No. 1.

30-INCH DOUBLE-SURFACER SECTIONAL ROLLS.

3,800 Revolutions per Minute of Cylinder.

Power required to drive machine free.....7 horsepower

Material.	Rate of Feed per Minute.	Width of Cut in Inches.	Depth of Cut in Inches. Top Roll.	Bottom Roll.	Horsepower Required.
Hard Maple	34	10	1/8	1/16	13
" "	34	10	1/4	1/8	16
4,200 Revolutions per Minute of Cylinder.					
" "	60	28	1/16	1/16	34
" "	60	28	1/8	1/16	40
" "	40	28	1/8	1/16	35
" "	24	28	1/8	1/16	27.5
3,800 Revolutions per Minute of Cylinder.					
Soft Pine	34	19½	1/16	1/16	14
" "	34	29	1/8	1/16	17.5
" "	34	29	1/4	1/8	26
" "	34	8	1/4	1/8	11.5
" "	34	10	1/2	1/8	14.5
" "	40	11	1/4	1/8	19.5
" "	60	11	1/4	1/8	18
" "	60	11	5/16	1/16	19
" "	60	11	1/8	1/16	10.5
4,200 Revolutions per Minute of Cylinder.					
" "	60	29	1/16	1/16	27
" "	60	29	3/16	1/16	38
" "	24	30	1/4	1/8	27

BACK KNIFE GEAR LATHE.

Stock Used in Turning—Oak.

Speed of spindle .....2,700 revolutions per minute
Power required to drive machine free..... 0.88 horsepower
2.12 inches square stock turned to 1.5 inches diameter..... 6 horsepower
Speed of spindle .....2,340 revolutions per minute
Power required to drive machine free..... 0.75 horsepower
3 inches square stock turned to 1.5 inches diameter.....12 horsepower
3 inches square stock turned to 1.5 inches diameter, very knotty .....14 horsepower

24 INCH BY 43 INCH STAVE-SAWING MACHINE.

Motor Belted Direct to Machine.

Power required to drive machine 1,760 revolutions per minute, free .....4 horsepower
Power required to drive machine 1,830 revolutions per minute, free .....4.5 horsepower
To cut 4.25 inches wide, 24 inches long, Birch Staves.....16.5 horsepower
To cut 7 inches wide, 24 inches long, Rock Maple Staves. 20 horsepower....1,760 revolutions per minute
To cut 9 inches wide, 24 inches long, Rock Maple Staves. .22 horsepower
To cut 12 inches wide, 24 inches long, Rock Maple Staves...26 horsepower. ..1,830 revolutions per minute
To cut 13 inches wide, 24 inches long, Rock Maple Staves...35 horsepower

15-INCH TANDEM SCRAPER.

Rock Maple.

Power required to run machine free..... 0.25 horsepower

	Width of Cut.	Thickness of Shaving	Horsepower
Feed 85 feet per minute—Two knives cutting.....	13.5 inches	0.005 inch	7.75
	13.5 inches	0.009 inch	9
	6.75 inches	0.0035 inch	5
One knife cutting.....	13.5 inches	0.005 inch	4.75
	13.5 inches	0.009 inch	5.75
	6.75 inches	0.0035 inch	3.25
Feed 120 feet per minute—Two knives cutting.....	13.5 inches	0.0035 inch	7.5
	6.75 inches	0.0035 inch	6.75
	11 inches	0.0075 inch	9
One knife cutting.....	6.75 inches	0.0035 inch	5.5
	13.5 inches	0.004 inch	6
	13.5 inches	0.0065 inch	7
	13.5 inches	0.008 inch	8

DOUBLE-SPINDLE SHAPER.

Revolutions of Spindle, 7,365.

Cuts were taken with two knives between 3 inch collars.
Power required to drive countershaft without machine..... 0.75 horsepower
Power required to drive machine, both spindles and countershaft..... 2.5 horsepower
Light work, ⅛ inch cut..... 3.25 horsepower
Heavy work, ¼ inch cut..... 4.5 horsepower
Power required to drive machine, one spindle and countershaft..... 1.5 horsepower
Light work, ⅛ inch cut..... 2.0 horsepower
Heavy work, ¼ inch cut..... 2.75 horsepower

POWER REQUIREMENTS OF BLOWERS.

Size of Blower		Pressure 2 oz.	3 oz.	4 oz.
30 inches	Horsepower	4.5	8.0	12.0
40 inches	Horsepower	7.5	14.0	21.5
50 inches	Horsepower	12.0	22.0	34.0
60 inches	Horsepower	17.5	31.5	49.0
70 inches	Horsepower	20.5	37.0	57.0
80 inches	Horsepower	27.0	50.0	80.0

Woodworking Plants—Data Sheet No. 2.

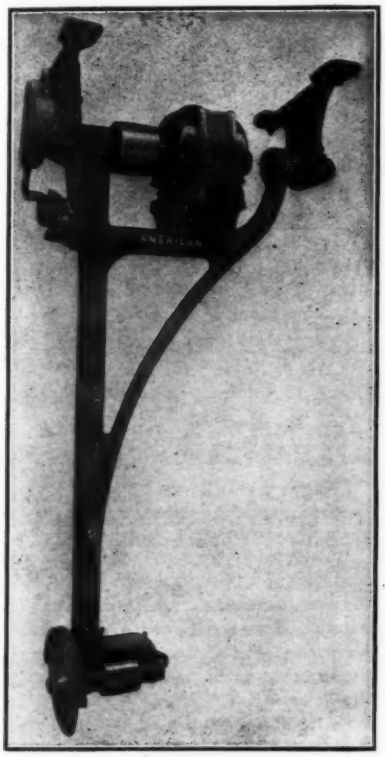
The following table gives the name, size, capacity and horsepower of the woodworking machines usually found in average woodworking plants.*

The minimum horsepower should be used when the lay-out is for group drive with soft wood and moderate feed and cut, or with individual drive where the work is light and the service very intermittent. The maximum horsepower should be used on all individual drives with maximum feed and cut and with medium or hard wood.

Machine	Size	Capacity. Vertical	Capacity. Horizontal	Horsepower
Band Resaw	54 inches	30 inches	20 inches	25 - 35
Band Resaw	44 inches	24 inches	12 inches	15 - 20
Power-feed Band Rip-Saw	No. 2	12 inches	15 inches	7.5 - 15
Self-feed Band Rip-Saw	No. 1	15 inches	28 inches	5 - 10
Band Saw	42 inches	20 inches	42 inches	3 - 4
Band Saw	36 inches	16 inches	36 inches	2 - 4
Band Saw	34 inches	12 inches	33½ inches	1.5 - 3
Band Saw	30 inches	12 inches	29 inches	1.5 - 3
Scroll Saw, Self-feed				2
Circular Rip-Saw	No. 2	25 inches	6 inches	10 - 15
Self-Feed Circular Rip-Saw	No. 0	15 inches	5½ inches	7.5 - 15
Rip Saw	No. 2	24 inches	5 inches	5 - 10
Rip Saw	No. 3	16 inches	20 inches	7.5 - 15
Rip Saw	No. 6	30 inches	36 inches	10 - 20
Double Cut-off Saw	No. 2, 3, 4			5 - 10
Swing Saw—Heavy				7.5 - 15
Swing Saw—Medium				5 - 7.5
Swing Saw—Light				3 - 5
Combination Saw and Dado Machine	No. 7½	21 inches	1 inch	4 - 7.5
Combination Saw and Dado Machine	No. 11, 12	15 inches	4 inches	4 - 7.5
Vertical Borer	No. 1, 2			3 - 5
Horizontal Boring Machine	No. 1, 2½			1 - 4
Hand-feed Dowel Machine	No. 1, 2, 3			2 - 5
Heavy Power Mortiser	No. 1			4 - 7.5
Heavy Power Mortiser	No. 2, 3			3 - 5
Heavy Bit Mortiser	No. 4			3 - 5
Multiple Bit Mortiser	No. 5	3 and 4 spindle		5 - 7.5
Heavy Double Door Sticker	No. 6	18 inches	4 inches	5
Sash Sticker	No. 3½	16 inches	4 inches	3 - 5
Sash Sticker	No. 1			4 - 7.5
Automatic Blind Slat Tenoner				3 - 5
Self-feed Blind Slat Tenoner				1.5
Sash Dovetailing Machine				5 - 10
Power-feed Panel Raiser	No. 5			3 - 5
Rabbeting and Jointing Machine	No. 7	26 inches wide		3 - 5
Sash Jointing and Sand Papering Machine	No. 1, 2, 3, 4			4 - 7.5
Blind Slat Mortising Machine				5 - 10
Relisher and Mortiser	No. 2			4 - 7.5
Sash Relisher and Mortiser	No. 10			3 - 5
Automatic Knife Lathe	No. 3	40 inches to 50 inches		10 - 20
Automatic Knife Lathe	No. 1½			5 - 10
Pattern Makers Lathe		20 inches by 24 inches swing		2 - 4
Two-Spindle Shaper	No. 2½			3 - 7.5
Two-Spindle Shaper	No. 3			3 - 5
Tenoning Machine	No. 1	20 inches by 5½ inches		5 - 10
Tenoning Machine	No. 2½	15 inches by 5¼ inches		5 - 10
Double-end Tenoning Machine				10 - 20
Column Sander	No. 9			2 - 5
Surface Sanding Machine	No. 15			2 - 5
Drum Sander	No. 5			1 - 3
Sand Belt	No. 8			1 - 3
Sand Belt	No. 14			2 - 5
Three-Drum Sander	30 inches			10 - 20
Three-Drum Sander	42 inches			15 - 25
Three-Drum Sander	66 ins.-72 ins.			25 - 35
One-Drum Sander	30 ins.-42 ins.			7.5 - 15
Two-Drum Sander	30 ins.-48 ins.			10 - 20
Scraping Machine	30 inches			15 - 25
Four-Sided Molder	No. 20	8 inches by	4 inches	8 - 15
Four-Sided Molder	No. 1	6 inches by	4 inches	5 - 10
Three-Sided Molder	No. 1	6 inches by	4 inches	5 - 7.5
Two-Sided Molder	No. 1	6 inches by	4 inches	4 - 5
One-Sided Molder	No. 1	6 inches by	4 inches	3 - 5
Six-Roll Planer and Surfacer		24 inches by	8 inches	15 - 25
Four-Roll Double Surfacer	No. 45	30 inches by	8 inches	20 - 35
Six-Roll Double Surfacer	No. 51	30 inches by	8 inches	15 - 25
Single Surfacer	No. 5	24 inches by	8 inches	5 - 10
Jointer and Buzz Planer	No. 1	8 inches by	16 inches	3 - 5
Jointer and Buzz Planer	No. 1	30 inches by	36 inches	5 - 7.5

*Data furnished by the American Wood Working Machinery Company, Rochester, N. Y.

department. As the power required to drive a blower varies as the cube of the speed, the pressure being constant, it is imperative that the speed be kept as low as is consistent with good operating results. The power required is also proportional to the amount of air moved, hence no more air should be taken through the blower than is needed to maintain proper suction at the machines and to keep the piping from clogging. If a blower running at 1,200 revolutions per minute and requiring 20 horsepower is speeded up to 1,500 revolutions per minute it will require approximately 39 horsepower to drive it. While the suction is increased 25 per cent the power is nearly double.



Swing Saw.

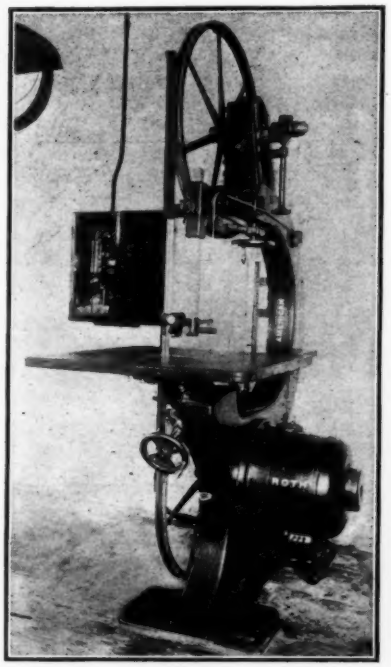
Each of the main blowers should be connected with a separate pipe to the wood waste collector and should be operated at a pressure of from two to four ounces of water. Tight piping, and dampers at each machine which are closed when the machine is idle, reduce the power consumption. The closing of dampers should not be carried to extremes when there are but few machines running as it is obvious that the condition will obtain when there will not be sufficient air in the pipe to keep the heavier particles of wood from settling to the bottom, choking up the piping.

The heavier woodworking machines and particularly those producing a large amount of dust and chips should be equipped with individual blowers amply capable of carrying off promptly all of the refuse. These motors can be driven from one of the rotary parts of the machine or directly from the machine's source of power.

The accompanying data (see Data Sheet No. 1) will be of use in selecting motors for blower drive. Caution must be used in determining the speed and pressure of the blower. The average blower operating without suction or discharge piping takes an immense amount of power in comparison to what it would with the average restrictions on the suction side.

Illumination.

All factories have some illumination, but most of them are so inadequately lighted that the production is greatly decreased during that part of the day



Band Saw.

when artificial illumination is used. While the first cost of the lighting systems for these factories is somewhat less than that of a first-class system, the amount of energy used is generally equal to or greater than what it would be with an efficient system of lighting.

Advantages of Efficient Illumination.

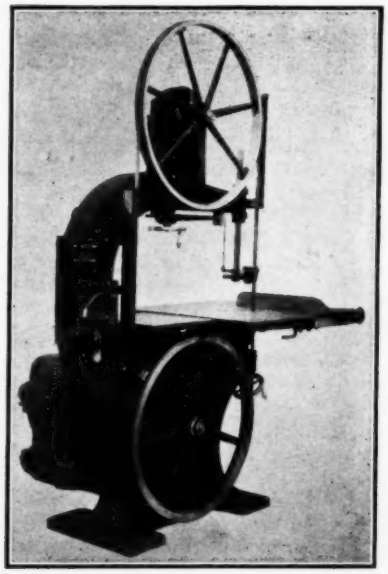
Experience proves that first-class lighting increases the output, improves the quality, decrease the number of "seconds," makes the factory more cheerful, and decreases the number of accidents. It will be found that where old systems of lighting are still used, which consist of bare incandescent lamps and drop cords so located that they shine more in the operator's eyes than on his work, or where there are a few scattered arcs casting deep shadows, there is the greatest opportunity for improvement and increased factory profits.

Economy of Efficient Illumination.

Whether or not an improvement in illumination is economically justifiable can be determined by a comparison of the cost of a first-class lighting system with the estimate of increase in output, et cetera, as previously mentioned. The output with first-class illumination should be just as large as with daylight. The increase in production should pay for the proposed lighting installation inside of two or three years.

Energy Consumption.

It has been found that in the average factory most of the lighting load comes on in the afternoon, one hour before the street arcs, and in the morning is cut off one hour after the street arcs. With the aid of a standard arc light schedule the number of minutes per day



Band Saw.

that the greater part of the lamp load will be on can be readily determined. It will be necessary to burn a few lamps throughout the day at those machines not having sufficient natural lighting. This item will be practically zero in a modern factory and not over 15 per cent in the average one. The yearly energy consumption will be increased approximately 10 per cent on account of cloudy weather.

Kind and Amount of Light.

Tungsten and carbon incandescent lamps are most suitable as sources of illumination in woodworking plants, the latter being used in all cases where there is considerable chance of breakage. General illumination can often be used advantageously especially in

furniture factories. In planing mills, where the machines are large and somewhat scattered one or two lamps over each machine should be used rather than drop cords. Drop cords should not be used except where overhead lighting is impracticable.

The intensity of illumination for the average run of work should be 2.5 foot-candles. For rough work, 1.75 foot-candles will be sufficient. Five foot-candles will be necessary for finishing work on furniture.

Lighting Layout.

Particular attention should be given to so locating the light sources that the maximum amount of light emitted by the lamp will travel in a direction normal to the surface of the working plane. If most of the work is on a plane parallel with the floor the lamps should be overhead and equipped with reflectors to throw the light downward. If the working plane is normal to the floor the lamps should be placed at one side and their reflectors should direct as much of the light as possible normal to its surface. The lamps should be high enough above the machines so as to be out of the way and also give fairly uniform illumination.

The spacing of the lamps depends upon the quality of illumination desired. To obtain the same quality of illumination in a factory where there is line-shaft drive, numerous posts, high racks and shelves, will require many more outlets than in the one using individual motor drive and having fewer obstructions. So many items enter into the number and location of the lamps that no general rules can be formulated. In addition to the obstructions mentioned, the height of the ceiling and the quality of illumination desired should be considered. For general illumination in the average large furniture factory, which has few obstructions to light, one lamp per 150 square feet of floor space, ten feet above the floor, will give satisfactory results. The size of this unit will depend on the intensity of illumination desired. When drop cords are necessary the lamps should be close to the work and well covered with opaque reflectors. No general lighting should be attempted without reflectors.

Reflectors.

As the proper maintenance of the lighting system in this sort of a factory is rather high, due to the quantity of dust, special attention should be given to the selection of reflectors with smooth surfaces so that the amount of dust collected will be a minimum. If opaque reflectors are used their interiors should be polished surfaces. When glass reflectors are desired only clear glass should be selected and no reflectors which depend on the light passing through the glass for any considerable part of the illumination, should be used. The dust settling on the outside of such a reflector makes it worthless in a very short time. There should be sufficient space between the lamp and reflector so that the dust can be easily brushed out. Only clear lamps should be used.

Maintenance.

In addition to brushing the dust off the reflectors frequently they should be thoroughly washed at least once a month. Care should be taken to protect the lamps from flying chips and pieces of wood. The lamps should not be closer than one foot to a high-speed belt unless protected by a grounded metal guard.

Commercial Practice
Management, Rates, New Business

HOW TO INCREASE REVENUES IN SMALL TOWNS.

By R. E. Brown.

The question of how to increase revenue is one which is before the central-station manager always, and one which he is in some way or other always endeavoring to solve to the company's satisfaction as well as to his own. It is one which can not be answered or solved by any one rule or answer but each property must be a rule in and by itself and worked out individually.

In this article I will not endeavor or pretend to tell how to increase your revenue in your city or town, but will simply state the results accomplished by some of the methods of operation we have put into use in our own case. I will mention very briefly five of the many different subjects which enter into this very necessary and important part of the electric business, viz., (1) new-business department; (2) newspaper advertising; (3) sale of electric motors; (4) window lighting; and (5) electric signs.

The new-business development in Mankato has been due to the progressive policies adopted by the management. These policies are briefly outlined in this paper which was presented before the Minnesota Electric Association. The author is manager of the Mankato company.

In Mankato we have, especially in the last two years, given a great deal of attention to the new-business department, and with considerable success. We have a good man at the head of this department and he has full charge of our different appliances, both gas and electric, and gives almost his entire time to work in this particular department.

Newspaper Advertising.

Very good results have been obtained by using liberal space in the daily papers from time to time calling attention to some special offer or proposition, which we may have at the time, of special interest to the consumer and patron. In the electrical department at different times special advertising was done on electric toasters by making certain attractive offers and at other times on electric flat irons in the proper season when this would be especially attractive to the housewife, and at other times very good and immediate results have been obtained on certain house-wiring campaigns open from 30 to 60 days or for stated length of time. Especially on the house-wiring campaign, which was carried on during the last season, do we think we have had good results. The proposition in the rough entitled a new consumer, who would wire and put fixtures in his house and connect up in a certain length of time, to a rebate of 20 per cent on the expense of this wiring and fixture work but with the condition that this rebate should not exceed $10.00. It was surprising to see the great number who took advantage of this especially good proposition. Viewing it from the company's standpoint, this offer relieved us from any other expense of any kind in the way of soliciting, etc., to obtain this new business, as it came without effort to our office and gave

us immediate and very satisfactory results.

Electric Motors.

In soliciting for motors, the company has, in a good many cases, had its new-business man investigate, with the consumer's consent, the true cost of steam operation in the plant under consideration and after this amount was arrived at the company would make a proposition for a trial installation, giving an approximate estimate on what would be saved by using electric motors. The company has installed a good many motors by this method and has, as yet, not taken one installation out where the trial test has been made. By these methods we have been enabled to practically change over nearly everything in our city from steam to electric drive, with very few exceptions. Will state here that we have just completed an installation of 12 motors with a total of about 200 horsepower in our large woolen mills in Mankato which heretofore used steam entirely for power purposes.

The company has also, recently, installed electric motors in nearly all of the Mankato schools, including the State Normal, High School, Model School, and Grammar schools, which motors are used for operating fans for ventilating and heating purposes and which we think is one of the very best classes of business, as this particular kind of load is entirely a day load, going on about 8:30 in the morning and going off at about 4 o'clock in the afternoon.

The policy of a company in regard to placing of motors should be to charge only enough to cover the cost of the material and labor and in that way keep the first cost down as much as possible. The economy of the new service, freedom from heat and dirt, and a great saving in floor space will accomplish the rest. Another good source of additional revenue is in pumping of water with electric motors. In Mankato we have just connected up two 30-horsepower motors to operate pumps for the village of North Mankato which takes its water supply from artesian wells and pumps same into a reservoir some 180 feet higher than the source of supply. And in another place we have installed one of about the same size to pump from the city reservoir into a steel tank to give additional pressure for the higher portion of our city.

Window Lighting.

We have been able to add considerable to our connected load by making special campaigns for window lighting, taking certain hours and certain units and making a flat rate for each and every night in the month until 10 o'clock, turning the lights on and off for the consumer at the proper and contracted hours. This has been very effective as the majority of our merchants close their places of business at about 6:15 each night, excepting Saturdays, and what was once a dark street after those hours on week days, is now comparatively well lighted and bright and makes it very beneficial as well as good advertising for each and all of them. This department of the business brings good results as it makes the next door man sit up and take notice as to his competitors bright and very attractive display windows immediately next to his own very dark and unattractive ones.

Electric Signs.

This department has had a good deal of attention and has also enabled us to increase our load very much in the last two years. We make a certain flat rate on all of our signs which flat rate includes the cost of the sign, renewal of lamps, and turning on and off each and every night. Two years ago we had practically very few electric signs on our business streets but now, by the methods used by our company, have increased the number about 800 per cent.

A Valuable Publicity Publication.

One of the most effective house organs in the country, especially considering the size of the community in which it is published, is *The Booster*, which is issued monthly by the associated public utilities of New Albany and Jeffersonville, Ind., known as the North Side, referring to their relation to Louisville, Ky. The United Gas & Electric Company, which is one of the companies interested, has indicated that it has received great benefits from the publication.

The Booster does many things. It is devoted to the interests of the community, and publishes information relative to the growth and opportunities of the section; it strengthens its relations with the public through statements of policy and plans for betterments; it brings the employees of the companies closer together, by printing matter of interest to them and concerning their personal movements; and incidentally it is the organ of The Boosters' Club, an organization formed of about 300 officers and employees of the companies for the purpose of aiding in making the utilities more serviceable to the public.

Martin J. Insull, general manager of the United Gas & Electric Company, presented the policy of the corporation in the following *Booster* contribution:

"The policy of the North Side utilities is to establish harmonious relations with the communities served, appreciating that the interests of both are mutual. Public-service corporations and their patrons are really partners in the constructive work of building up communities. The corporations are constantly making extensions, which at the time of their completion cannot as a rule pay anything like a reasonable return on the investment made. This policy necessarily benefits everybody in the community, as the public cannot help but share in the material advantages that come with the resulting increase in population."

The work of the commercial department of the corporation, which is in charge of Anderson G. Moore, and which endeavors to bring new residents and industries to the North Side, is also given regular representation in *The Booster*.

Nashville Wiring Campaign.

The Nashville Railway & Light Company, of Nashville, Tenn., which is conducting a new-business campaign applying especially to old houses, is making a feature of advertising special propositions, applying to houses of various sizes, so that the prospective consumer may know exactly what the cost of wiring will be. A recent advertisement contained the following:

"We will wire your six-room house for electric light, six lights complete, ready to burn, for $14.75. Pay us $2.75 cash and a little each month with your light bill. Take a whole year to pay, if you like. No interest. We guarantee the work to be first-class in every particular.

"It is not necessary to break plaster, ruin decorations, tear up floors or rip out partitions. On the contrary, the work can be done with less bother and dirt than is caused when your parlor carpet is sent to the cleaners. The electrician of today works quietly and cleanly, and you hardly know the work is being done.

"Let us send the Estimate Man to tell you what it will cost to wire your home, and fully explain our Twelve-Months-to-Pay proposition."

Large Power Contracts.

The new-business department of the Appalachian Power Company, a Byllesby property located at Blue Field, W. Va., has recently entered into a contract with the Virginia Pocahontas Coal Company covering an installation of 1,400 horsepower in motors. The contract is drawn for a period of ten years and stipulates that the company will add 400 additional horsepower when needed.

Another contract recently closed calls for an installation of 600 horsepower in the plant of the Southern Gypsum Company. The yearly minimum for this installation will be $11,000.

A Follow-up System for Complaints.

T. K. Jackson, manager of the Mobile Electric Company, Mobile, Ala., has devised a plan of following up customers' complaints, by a return postcard system which has been of inestimable value in improving the relations between the company and its customers.

As soon as a complaint of service has received attention, post cards are mailed to the complainants, asking that they place a cross before the statement which answers the company's question and mail the return card. Following are the statements which the customers are asked to check:

The complaint was not taken care of.

The complaint was taken care of.

The complaint was taken care of to my entire satisfaction.

This plan has worked so well in Mobile and created such a favorable impression among the customers that H. M. Byllesby & Company, managers of this property, will put the plan in operation in all of the Byllesby properties.

New Office and Display Room in Louisville.

Plans have been announced by the Kentucky Electric Company, of Louisville, Ky., for a new office building and display quarters which will be erected on Fourth Avenue near Chestnut Street. The building will be leased. Work will begin immediately. The structure will be three stories high, with a basement, the front consisting of a handsome chocolate-colored brick, with green tile at the top.

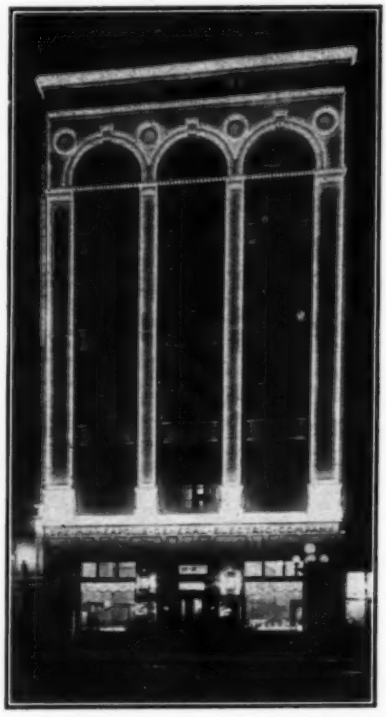
The creation of public interest in electrical appliances of all kinds will be secured by a novel method. The basement will be arranged in the form of a seven-room house, and all appliances suitable for the various apartments will be shown. The rooms will include kitchen, laundry, dining room, bedroom, hall, library and den. Over two hundred appliances will be shown and demonstrations will be made there.

The first floor will be largely devoted to display purposes, illuminating units of as many kinds as will harmonize with the general plan of the building being included. The displays will be near the entrance of the building, so as to enable attention to be secured most easily. The commercial offices will be at the rear of this floor, while the general, accounting and new-business departments will be in the upper stories. The exterior will be lighted by the indirect system, and the roof will carry a 2,000-lamp sign of novel design.

Since the company began business it has had its offices at the plant, near Third and Washington Streets, and these quarters will be used for the distribution department. It is hoped to get into the new building about September 1.

Outline Lighting of a Central-Station Office Building.

The accompanying illustration shows the outline lighting of the Minneapolis General Electric Company's office at night. The installation comprises 1,826 five-watt, 12-volt, tungsten sign lamps. All work was installed by the company's wiremen under supervision of



Outline Lighting of the Minneapolis General Electric Company's Office Building.

the commercial department. The wiring is series multiple, consisting of 11 multiple groups of 12-volt lamps in series across 114-volt, direct-current mains. Special galvanized-iron molding, of the company's own design, is used throughout. Practically all of the molding is flush with the brick work due to a receding margin on each side of the pillasters. Full advantage of the architectural features of the building have been taken to produce something in the way of decorative lighting that would be dignified and still be spectacular.

The company states that this installation has been a great stimulus to decorative lighting in Minneapolis, and considerable business has been signed on the strength of it.

One point that is particularly noteworthy in connection with this installation is the extremely small number of outages that have occurred. The installation was completed and current turned on December 8 and although the lamps have been in operation each successive night since that date, the renewals have only totaled 55, an average of two lamps per night.

In connection with this lighting it is interesting to note that Robert W. Clark, of the Minneapolis General Electric Company, claims the distinction of having originated the demand for low-voltage tungsten lamps for sign and outline lighting, and the first installation of five-watt lamps was made in an electric sign for Minneapolis, these lamps having been the first of the kind manufactured.

One Method of Meeting Competition.

Several years ago when there were two central stations operating in Faribault, Minn., competition was very severe and no opportunity for securing new business was neglected. One installation made then is of particular interest and indicates a manner of successfully meeting isolated-plant competition.

The installation was made in a school, which was open practically nine months of the year and had a connected load, at that time, of 800, 16-candlepower equivalents. The consumers Power Company, of which B. W. Cowperthwait is local manager, made several attempts to secure the business, but owing to the fact that in Minnesota heating is a large item, amounting in this case to $5,000 per year, it was at first unsuccessful. Later the company entered into a contract with the school by which the heating and lighting plant was to be taken over by the electric Company. The electrical equipment, which was obsolete, was replaced by apparatus furnished by the company and an engineer employed to operate the boiler plant, which was in first-class condition.

In operating the plant the Consumers Power Company has virtually received as compensation the cost of the coal required for heating. Therefore the electricity is considered as a by-product from 6 to 9 months of the year. The lighting installation has been increased somewhat during recent years. Today the company secures a by-product of electricity generated from burning $7,000 worth of fuel.

The Executive Committee of the Commercial Section, N. E. L. A., met in Minneapolis, April 4, for final discussion of reports to be presented at Seattle.

Electrical Construction

ELECTRICAL ORDINANCES AND INSPECTION.[1]

By F .G. Dustin.

At a recent meeting of this society considerable attention was given to the consideration of electrical specifications and contracts and certain objectional sections of such specifications were quoted, cussed and discussed.

Contracts based on specifications are agreements between contracting parties to do specific acts in a specific way for certain considerations and under certain penalties for non-compliance. It is, therefore, obvious that an ideal specification would be so clearly and precisely expressed that the requirements of such agreement could be executed in a manner to leave no ground for argument.

Municipal ordinances which include the issuance of permits are nothing but contracts between the municipality and the recipients of such permits to do certain acts under specifications set forth in such ordinances. These ordinance contracts are necessarily binding on both parties, either of which has recourse, in the courts, for the securing of the expressed rights and privileges. The electrical inspector and the electrical contractor are equally subject to the provisions of the written ordinance and neither may wilfully harass or usurp the rights of the other.

The ordinance must be constitutional, reasonable and based on safe and standard practice, though the city, under its general police powers, may enact such ordinances as will safeguard and protect itself as well as the individual citizen. The electric inspector, as the representative of the city, is invested with certain police powers which enable him to enforce the requirements of the ordinance specifications, to the end that the city and its citizens shall be protected against dangerous and hazardous conditions in electrical installations. Nearly all electrical ordinances are based on the National Code, as representing standard practice, and are further amplified to meet local conditions. Local conditions should include state laws, climatic conditions, types of prevalent building construction, relative congestion of buildings, particular hazards of certain kinds of business, effects on or by certain local electrical distribution methods, etc. The progress of the art must be recognized by the enactment of amendatory ordinances, from time to time, that newly approved methods and apparatus shall be employed.

The inspector should be alert to recognize and adopt such methods and materials as will make for more substantial, better and safer construction, and he owes it to the community which he represents to recommend and work for the adoption of such improved methods and apparatus. In the past few years, we must have observed a decided tendency to recognize the work of the electrical inspector as a separate profession in the electrical-engineering world, and a much less inclination to consider such an office as a purely political one.

There is no doubt in the mind of a thinking citizen that years of special work should better fit the right type of inspector for more efficient and larger service and that the industry as a whole should profit in the stability of standard inspection and interpretation.

It is the opinion of the speaker that the large majority of the electrical contractors are, like all other good citizens, very desirous of strictly complying with duly enacted law and always willing to submit to the rulings of the inspector when assured that such rulings are standard and uniform and not contingent on whims and favoritism.

Unfortunately no two installations are ever exactly alike and it is for this reason that interpretations vary apparently. It is without doubt the most difficult duty of a conscientious inspector to so interpret and decide that manifest fairness shall prevail in the minds of conflicting interests in each case.

The electrical inspector, under the provisions of most ordinances, must act in several capacities, such as consulting engineer, judge, arbitrator, and policeman. As consulting engineer, he should be a deep student of his profession, so that he can be the better able to recognize and advocate the best practice in actual construction. As a judge, he should be thoroughly familiar with the law and broad-minded in its interpretation. As arbitrator, he should be absolutely fair and impartial, and as a policeman, he should abstain from clubbing and try to forget that he wears a star. The inspector ought to have such a divine nature that he will never carry a grudge from one job to another, but deal with each piece of work strictly on its merits.

One of the peculiarities of inspection work is the often grudging compliance on the part of the contractor in effecting minor alterations on unacceptable work when larger and more expensive changes are frequently made with little comment.

One hesitates to believe that though the little mistakes were made through oversight, the large ones were purposely done for the sake of gain and with the hope that they would get by through brazen boldness, for it has been known to happen that some inspectors in their zealous search for petty defects have actually passed some glaring violation with their eyes out of focus.

In conclusion just a few words might be said on the social relation between the inspector and the contractor. Does the inspector gain or lose prestige by maintaining a personal friendship with the contracting fraternity? The speaker maintains that material benefits result from such a personal but dignified relationship. The inspector's best friends are those who have learned to respect him, and not because of a display of favoritism. No real friend asks for favors, for he must realize that a slight favor to one may mean a larger favor to another, and such action would start a chain of disorded that would break the strongest organization in existence.

Therefore, "Equal rights to all and special privileges to none;" so let us all continue to dwell in the harmony so manifest this evening, and echo that sentiment from Mount Olympus, "All together —all the time—for everything electrical."

1 Address at the dinner of the Minnesota Branch of the American Institute of Electrical Engineers, March 19, 1912.

Fire Caused by Water in Panel. Box.

A characteristic breakdown of an electrical equipment, superinduced by a combination of incidents in a fireproof concrete hotel in New Jersey, on February 24, presents, by reason of the superior construction of the building, one of the most interesting and instructive possibilities of fire which the underwriters have observed.

The hotel is an imposing structure, built of concrete, brick and stone, with "Mackite" partitions. It is eight stories, and equipped with an isolated lighting plant consisting of direct-connected units of large capacity at 110 volts, together with switchboards and other accessories for the exclusive illumination of building and grounds.

From the switchboard in the basement,

a complete conduit system radiates to smaller switch and cutout panels, located throughout the building.

These panels are slate, mounted in steel boxes. The risers from the main switchboard enter at the bottom and the branch lighting circuits at the top. The wires are all of rubber insulation with double braid, the total capacity of each distributing unit being approximately two kilowatts.

All panels and boxes are set flush with the wall, inclosed with wood trims and panel doors. One of these panel equipments is situated in a hall on the top floor, and the conduits, 15 in number, rise through the partition and radiate in all directions on the unfinished tile floor of the attic.

In the attic are located enormous tanks to which water for general house purposes is pumped. They have overflow pipes which run through the cement roof, making a short downward bend, depositing directly upon the roof with approximately a two-foot fall. Coincidentally, the point of deposit of one of these overflow pipes is plumb with the point where the 15 conduits rise and diverge in the ceiling below. Whether through a broken tile or the disintegration of the same through the continual flushing of the pipe, water seeped through the concrete and dropped to and around the mass of pipes below. The water followed these pipes down through the partition, finding a lodging in the steel box, and saturating the rubber-insulated risers resting in the bottom gutter.

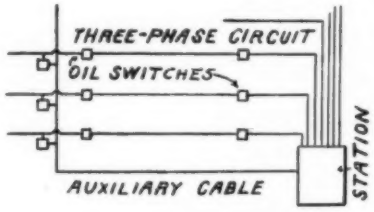
One of the main risers entering this steel box took a sharp right-angle turn when leaving the conduit, resting easily and without abrasion on the bottom of the gutter, but partly submerged in the water or subjected to continual dampness, rendering it susceptible to a total collapse.

In the rear of the building, a siding admits coal cars to the yard over which a trolley wire is suspended. Immediately overhanging this is a pair of secondary feed wires from a transformer of the local electric light company which enter the power house, connecting to the main switchboard for the furnishing of current during the inoperation of the hotel plant. These service wires became crossed with the trolley, admitting 500 volts of grounded current to the system of risers throughout the building, which withstood the strain except at the panel board referred to, where it found the weak and broken-down insulation and formed a return through the conduit system to earth, causing a violent short-circuit, tearing a hole about two inches through the gutter of the steel box and igniting the rubber-insulated circuit wires contained therein. The fire ensuing ignited the wood trim and panel door; these burning away from their fastenings and dropping to the floor communicated fire to base board and carpet. At this junction the fire was discovered and extinguished.

The loss was confined to the destruction of the panel board and insulated wires, requiring a renewal of all circuits fed from this panel board, the panel trim and door, in addition to the base board and carpet.

Auxiliary Feeders in a Cable Network.

An article in a recent number of *Electricity* (London), describes the provisions made by a certain central station to insure its service against interruptions which might arise from accidents in its feeder system. The nature of the scheme adopted is indicated in the accompanying figure. The main feeders are taken along a street to the business section, where they are branched. These feeders consist of single-core cables, there being, therefore, three separate cables per three-phase circuit, as shown in the diagram; and in each line there is an oil switch at the station and another on the station side of the point where the circuit branches, near the branching point. An auxiliary three-wire cable is laid alongside each circuit and connected to the conductors thereof by means of oil switches located just on the station side of the point where the circuit is divided up. In case of a breakdown in one of the mains, the disabled feeder is cut out and the auxiliary feeder switched in and kept in service until the necessary repairs have been made. Under normal operating conditions the oil switches at the end of the auxiliary circuit are kept open, of course.



Feeders and Auxiliary Cable.

The feeder voltage of the central station in question is 2,300; but oil switches designed for 6,600 volts are used, and hence any feeder can be opened safely, it is stated, on full load. The three interconnecting oil switches in each of the three-wire auxiliary cables are located in columnar switch boxes placed on the edge of the pavement or at any other convenient point.

A HUMMING GROUND.

By A. P. Broadhead.

A very peculiar instance was called to the writer's attention when a householder complained of a violent humming in the vicinity of his gas and electric meters, which had grown to be unbearable.

It was at first thought that the humming must be due to the action of the 60-cycle alternating current in the loose laminations of the stator windings of the electric meter. But when the main switch was opened the noise continued as much as ever.

When the gas meter was disconnected, a fat spark was noticed at both the inlet and the outlet of the gas meter, and when the latter was taken down the noise ceased at once. A voltmeter placed across the inlet and outlet to the gas meter, gave a reading of 90 volts, and a similar reading was obtained between the inlet of the gas meter and the steam pipe near by.

Upon further investigation an old and abandoned underground electric service was discovered alongside of the gas pipe. Not wishing to place insulating joints on the gas meter, the street was dug up, and it was found that the gas and electric service pipes crossed and touched each other just outside the building line. There was a strong odor of gas and the earth was blackened.

Evidently, the gas main had been made porous by the action of the electricity from the grounded service, and at the gas meter a drum effect resulted from the gaseous dielectric inclosed in the casing of the meter. Had the cross been permitted to remain very much longer a bad gas leak would have probably resulted.

In eliminating the trouble the service conduit was cut at the point where it left the junction box, the gas meter was replaced and when the main switch was again closed no sound was heard, and no trouble has been found with the service since.

Among the Contractors.

J. B. Wilson has discontinued his connection with the Wilson Electric Company, electrical contractors, Grand Opera House Block, Canton, O., and has formed a separate company, of which he is the head. Mr. Wilson has been on the Pacific Coast for several months, but is now prepared to actively engage in a general electrical contracting business at Canton.

The James Clark, Jr., Electric Company, of Louisville, Ky., has sold 35 motors, aggregating 425 horsepower, to the Louisville Veneer Mills.

Armored Wire Makes it Easy to Wire Old Houses for Electricity.

Once it was thought quite impossible to wire an old building for electric light. People owning fine old homes did not want them torn up and disfigured by a gang of electricians in an effort to install electric wires. For this reason they used oil and gas for many years although they realized that electricity was better and safer.

Unfortunately electricity has been with us but a few years, at most, and by far the greater number of homes in this country were erected before the advent of electric light. It is quite an easy matter to install electricity in a new building in course of construction. In this case the wiring is all done before the plaster, floors and molding are put in place. When an attempt was made to put in a network of concealed wiring in an old house the result was anything but pleasing.

But now all this is changed and it is possible to wire the largest homes without breaking the plaster, and still have the wiring completely concealed. It can readily be imagined that when circuits can be laid across the floor by raising a single board and can be run in the other direction at right angles to this simply by removing and afterwards replacing a part of the baseboard, the flooring need be disturbed very little.

As for the outlets for brackets and switches, baseboard outlets, etc., they are secured by "fishing" the wires up or down between the joist and the lathing which forms the wall on either side, the wires being brought out readily at any point previously selected after a test of the space shows it to be free of obstructions. In this way some of the finest residences, containing beautiful handpainted ceilings and tapestried walls, have been completely wired without the necessity of a single dollar being expended for redecoration on account of the wiring work.

Suppose that we take the average two-story house with attic and basement, or in place of the attic, the usual space between the ceiling of the upper floor and a flat roof, which is generally of ample size for the required work. If the electric mains are on poles in the alley at the rear, they must be brought over to a point on the outside of the building from which a straight drop can be made in iron armored pipe to the basement where the service meter, cutout box, and main switch may be located. The next step is to explore the walls preparatory to running the circuit wires, in flexible conduit, to the points where light or switch outlets are wanted. This is done very easily and is called "fish work."

In "fishing" work a piece of flexible steel tape is used to explore the space between joists, and perhaps a baseboard section is removed upstairs, and a brass chain, such as that used by plumbers, is dropped down to meet this from above. When it is found that it is quite easy to pull the chain right through, it is a pretty safe conclusion that the electric circuit wire in its flexible conduit will be able to follow through in the same place, and the matter is generally worked out in that way. Having located the center of distribution, the number of lamps that will be required in each room are carefully noted, and the number of circuits which will be required to carry them is readily determined by the standard rules permitting a load of 660 watts per circuit. A rough working plan is then formed with the object of reaching all the outlets with the least waste of material and labor; that is, in the most direct manner. For instance, a single circuit may be all that is needed for each floor in a moderate-sized residence, a branch being taken off for each bedroom, and this again subdivided, if necessary, for the different outlets in that room.

Wherever a wall switch is to control a lighting connection, one side of the circuit is led down to the switch and looped back again, and in all this work the same method of exploration and fish work is carried out. An experienced wireman is able to get around almost any difficulty without having to cut plaster in order to reach his outlet. It may take a little more wire than he would use if he were installing the circuit while the house was in process of being built, but between the possibilities of running a circuit behind the baseboard around the room, or across the floor by raising a single board in the floor, or by putting a particular outlet on another circuit branch coming from a different direction entirely, and by leading circuits down occasionally in hardwood molding inside clothes closets and similar unimportant places, he is enabled by the exercise of a little ingenuity to put every switch and every light at practically the exact spot that may be indicated before the work is started, and never make a single hole in the plaster except at the various points where the fixtures or switch is to be attached. The wood trim around doors and windows frequently lends great assistance in doing concealed wiring without injury to the premises.

One of the valuable accessories of this sort of work is the flexible metallic conduit which enables the wires to be fished around in this way and yet covers and protects them in strict accordance with the best modern practice.

CHARGING FIELD OF GENERATOR.

By S. G. Frank.

In one of the plants of a large express company, where electric power was supplied from a generating station operated by the company itself, the building in which the generators were located was burned recently, the fire destroying all the electrical apparatus. Another building a hundred feet away contained all the shops of the company, and in these there were thirty motors, used in driving the various tools employed in the shops. Following the fire, therefore, the shops had to be shut down. Any extended interruption of the shop work, however, would have proved very embarrassing, and so the electrician of the company busied himself at once to provide another source of current. On the second day after the fire a generator of the proper size and voltage and also a 500-volt motor for driving it, were obtained, together with the necessary switchboard and meter equipment. Notwithstanding that the installation of this apparatus included the drilling of the board for meters and switches, the plant was started up on the afternoon of the day after that on which the apparatus was received, power for the 500-volt motor being supplied by the local central station. The plant would have been started several hours earlier, in fact, if it had not been for some trouble with the generator. When it was attempted to put this machine in operation, it was found that it did not pick up its voltage at all. Examination showed that the shunt field was opposing the series windings, but this should not have prevented the voltage from building up with the generator running light. The field connections were corrected, and the shunt field charged from the circuit supplying power to the 500-volt motor. This charging was done by lifting the brushes off the commutator and connecting the shunt field and a 220-volt lamp in series to the 500-volt circuit. When this had been done, the machine picked up its voltage nicely, and since then has given no trouble whatever.

Telegraph Work in Uruguay.

The President of Uruguay has promulgated the telegraph bill, which authorizes him to contract a loan of $380,000 for the reconstruction, repair and extension of the national telegraph lines, including the underground installation of the national line in the Department of Montevideo. The loan is to be repaid from the surpluses of the postoffice revenues.

DEMONSTRATING ELECTRIC LAMPS FOR FARMERS.

By G. W. Barlow.

There are great possibilities in the combination of the low-voltage tungsten lamp and the storage battery for electric lighting from an isolated plant, and especially upon farms.

Most farmers have a good gasoline engine or other source of power that is maintained for pumping, cream separating and feed grinding, and the sale of a small generator with proper storage battery is not difficult, provided it is undertaken properly, and yields a large and sure profit.

Our plan is to equip a rig, or better an auto, with sufficient small ignition batteries to get the proper voltage; then, after gaining the farmer's consent to ride out to his house and during the evening actually suspend a real fixture from his parlor ceiling, run flexible duplex to our rig outside and turn on the juice.

The effect upon the farmer and especially upon his wife and daughter, if any, is unmistakable, and since there is the actual light, the farmer's usual suspicions vanish in thin air and you have another pull to his next neighbor.

If the farmer has no engine, get the implement dealer to sell him one, thereby making your profits surer and giving the farmer the advantage of the implement dealer's installment proposition, which appeals to even the wealthy farmer.

Most farm pumps are over-engined, so it is generally possible to operate the generator while pumping or doing other work, thus making the electric outfit a by-product utilizer.

What is the Real Point of Entrance of the Service?

Not long ago there appeared an account of a serious fire in Toronto, Canada, which was caused by the breaking down of the insulation between overhead service wires brought into basements through standpipes. Again on March 9 a large quilting factory suffered a loss of $5,000 from a fire which if it had not been discovered early and the building had not been near a fire station would just as easily have caused a loss of $50,000.

The origin of the fire can best be explained by reference to the accompanying figures. Fig. 1 shows the main service box, which was located about seven feet from the entrance and into which the conduit was run from below. This two-inch pipe ran from the main fuses in the cabinet down to the ceiling of the basement and along this to the wall. Then passing to the outside, it ran up the wall a distance of 20 feet and terminated in an "F" condulet. The pipe carried three 1/0 stranded, old-Code rubber-covered cables, and three-phase power was delivered over these at 550 volts pressure.

As shown in Fig. 1 a hole was burnt in the conduit just above the main floor line. Fig. 2 shows the condition of the conduit under the main floor after the fire. From a point below the floor line the pipe was converted into two long strips of melted and badly burnt iron. It appeared as though a vicious arc had started just below the hole seen in Fig. 1 and cut its way through to the outside wall, at which point the pipe and the wires were burnt entirely off. When the firemen arrived there was fire around the pipe, and the pipe itself was spitting fire and molten metal in truly satanic fashion. No other origin of the fire than a breakdown of the circuit in the pipe could be discovered.

This job of wiring was installed two years ago by the best firm in this section, and, when completed, showed no defects during the thorough test to which it was submitted. Later, however, a steam pipe was run under the line of conduit; and it may be that the heat from this destroyed the insulation of the conductors and thus caused the trouble.

During the last Underwriters' meeting in New York a suggestion was made by H. F. Strickland, chief electrical inspector of the Canadian Fire Underwriters' Association, that all large power and lighting mains entering buildings in pipe should be provided with fuse protection on the outside, such as might be obtained by means of an "FF" condulet or some similar device. This suggestion was strongly indorsed by some others present, among whom was Mr. Paddon, of the New York State Board of Underwriters.

In the case of the installation described above Mr. Strickland insisted from the first that there should have been another set of fuses at the point

Fig. 1.—Cutout Cabinet Below Which Hole Was Burnt in Conduit.

where the pipe entered the wall. But as the conduit ran only seven feet before reaching the main steel cutout cabinet, the contractor and others maintained that the cabinet was the real point of entrance; and, as there was no trouble from this sort of installation on record then, the inspector passed the job. For the last year or so, though, fuses have been required at the wall in the case of services like this. What really is "the point of entrance" in such cases is a matter well worth debating.

Mr. Strickland is now to become chief electrical inspector for the new Provincial Inspection System of Ontario, and he declares that this fusing at the wall will become a *law* now, Code or no Code.

Fine Show Windows and Display Room.

There are those who would have us believe that electrical contractors as a class are not sufficiently cognizant of the best methods of advertising to be highly successful as merchants. We are given to understand, either by implication or by positive assertion, that the electrical contractor is a fellow who usually seeks some uninviting and but little frequented street for his business headquarters, and there maintains, if he elects to be a merchant as well as a contractor, a sort of combination of office and shop and store whose appearance is such as to deprive the place of most of its business-attracting power, if not, indeed, to make it actually repellent to people whose sense of good taste and orderliness is normally developed.

It must be admitted, it is true, that there are contractors who do make the mistake of seeking unfortunate locations for their places of business and who sometimes run a mixture of shop and store which is not always very inviting to the prospective customer. On the other hand, there are contractors in nearly every section now, and not a few of them, who make it a point to select as the location for their store the best and busiest trading street available, and who know the value of the well kept store room and properly managed show window, and, knowing, turn this knowledge into daily profit.

Windows of an Electrical Contractor's Store.

One firm which does this is the Levy Electric Company, of San Francisco, which has one of the most modern and up-to-date electrical stores in the West. A photograph of its show windows accompanies these notes. This store is on the principal street of San Francisco. There passes it daily suburban traffic from Oakland, Berkeley, Alameda and other points, in addition to the usual city traffic. Inside the store there are large display tables on which are shown nearly every make of electric iron, toaster and other heating device, and also electric vibrators and numerous other appliances. These tables are all tastefully arranged and the display, rearranged frequently.

The men are strong believers in the effectiveness of the right sort of show-window advertising. Each of their two windows is kept skilfully trimmed and the display is changed in one of them one week and in the other the next. One day in every week, too, a girl is kept in one of the windows to demonstrate an electric vibrator or some other domestic appliance. There are also some mechanical window attractions, one in particular being a doctor who demonstrates the utility of the vibrator.

The Levy Electric Company has been in business fourteen years. It does a general contracting business and maintains a wholesale and retail store. It handles everything electrical.

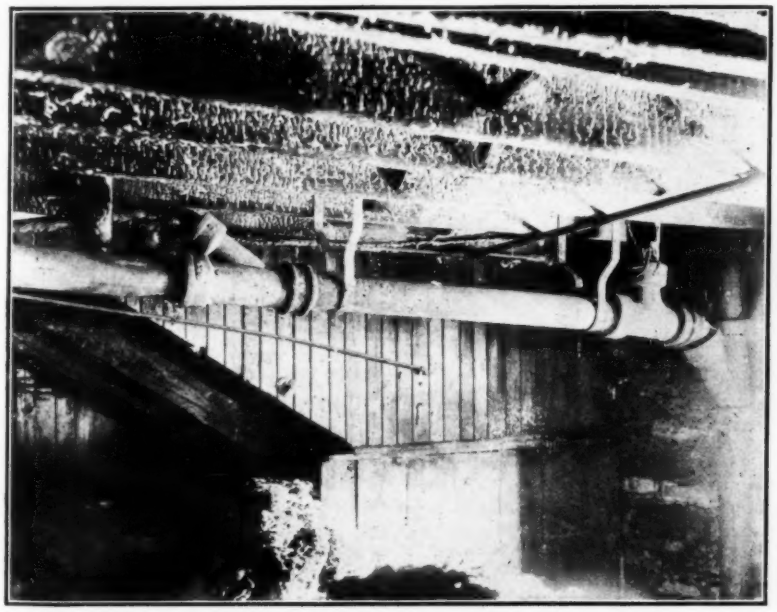


Fig. 2.—What Was Left of the Conduit on the Ceiling.
The Fused Strips of Iron Just Above the Large Pipe.

WIRING IN BOILER ROOMS.

By H. G. Wilson.

The methods employed in wiring boiler rooms are many and varied. Some of these are good, to be sure, but the majority of them, it must be admitted, are bad. In addition to being bad from the viewpoint of good construction and the requirements of insurance interests, and also lacking in the elements of permanency, the wiring is frequently done in such a way that it is practically impossible to arrange lamps and reflectors to meet the conditions essential to effective illumination. It not seldom happens, for example, that the arrangement is such that when the fireman or water tender wishes to see a pressure or a water gauge he is more or less blinded by a glaring light directly in the field of view.

The commonest type of boiler room wiring is illustrated in Fig. 1. In this figure the reader is supposed to view the circuit from above the boilers, except in that part of the figure on the extreme right, where the reader looks along the circuit in the direction the wires are run. As will be observed, short timbers of convenient size are secured in a horizontal position and to the lower surfaces of these the circuits are attached. Drop lamps for lighting the gauges are suspended in the manner indicated in the right-hand side of the diagram. Where construction of this kind is employed, the supports for the No. 14 wire, of which the circuits for lighting the boilers generally consist, are usually placed so far apart and the vibration is such that the breaking of wires is common. When these are repaired, it is generally the case that the joints are hastily and hence poorly made, and that the wires are left slack and unsightly. Moreover, circuits installed in this manner are very often in the way whenever repairs must be made on the boilers themselves.

In Fig. 2 another widely employed type of boiler-room wiring is illustrated. Here the wires are run along the ceiling in what is usually the hottest and most inaccessible place in the room. Moreover this sort of work often necessitates the use of drop cords 15 to 25 feet long for the lamps, and the tying of lamp cord around water columns and steam-gauge piping in order to hold the lamps in place is a practice not at all infrequent. Also, on account of the difficulty of reaching the circuits on the ceiling when repairs are needed, runs of cord installed for temporary service are often left for permanent use.

Side lights to be used for repair work and the inspection and cleaning of boilers are not thought of as a rule. Hence temporary extensions have often to be made, which results in a loss of time when time can least be spared. Such extensions, too, are generally not the sort of thing a man repairing a boiler finds it pleasant to handle; for he is very liable to receive shocks which may be rendered doubly disagreeable by the fact that his clothing and surroundings are wet and that he may even be lying on his back in such surroundings as these.

It is interesting to note in this connection that some of the large manufacturing plants which use alternating currents for lighting have installed small 4-to-1 transformers on the 110-volt circuits for stepping the voltage down for the extension lights used in the boiler rooms. This eliminates any special attention in making extensions and precludes the possibility of injury to workmen from electric shocks.

To install a system which will be devoid of the foregoing defects and reduce maintenance expenses to a minimum, a complete conduit system must be adopted.

A central cutout cabinet containing fuses and switches for all the circuits should be located in an easily accessible place, and within easy reach of the hand. Its location, however, should not be such as to expose it to mechanical injury from tools used in firing or from other sources. The number of boilers to be connected to a single cutout must usually be determined by local conditions, such as the total number of boilers in the room, and so on. When the conduit cannot be run over some surface or other, it should be held rigidly in place by means of strong iron brackets prepared especially for the purpose; and if the surface or the supporting brackets, as the case may be, are liable to be kept at temperatures higher than rubber insulation can safely stand, some good non-conductor of heat, such as asbestos board, should be placed between the pipe and its fastenings. This precaution will materially prolong the life of the circuit.

The proper location of outlets for lighting steam gauges and water columns will always depend mainly upon the type of reflector to be employed with the lamps. The reflector used here should be one that will throw most of the light on the gauges themselves and prevent glare from the lamps from interfering with the easy reading of these.

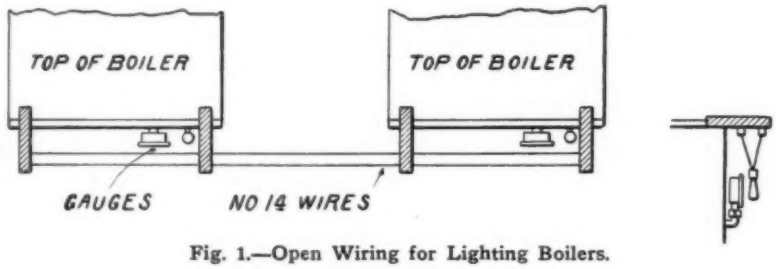


Fig. 1.—Open Wiring for Lighting Boilers.

Conduit work installed as in Figs. 3 and 4 is being used with good results in service of the kind in question. A number of other schemes may be worked out to meet special conditions. It will be observed that in the system shown in Fig. 3 the conduit circuit is run across the front of the boilers, and that taps are taken off through condulets and goosenecks for the gauge lights. In the system shown in Fig. 4 the conduit is run across in front of the boilers, and is supported by means of angle-iron braces, which are usually secured to the boiler front by means of screws in holes properly drilled and tapped.

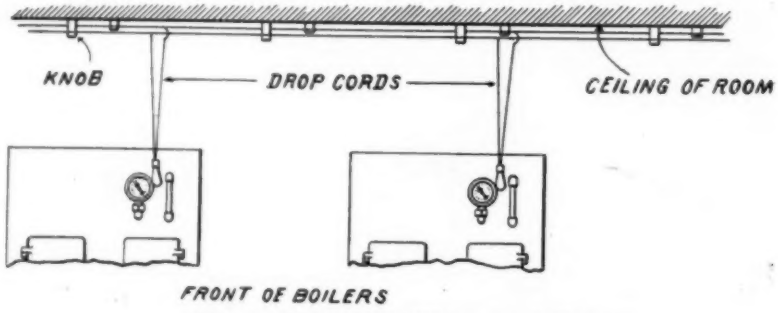


Fig. 2.—Open Knob Wiring on Ceiling.

For extension receptacles conduit may be run around the sides and back of the room, on the walls and about six feet above the floor, with outlets placed wherever they are likely to be needed. A good brand of elevator cable has been found to give the best results in making extension circuits. It is much more flexible than ordinary reinforced drop cord, and is also insulated better. Mica or hard-rubber sockets are to be preferred. They are not likely to be broken and their use also eliminates grounds. Strong guards where conduit work is adopted, to install the work so that the lamps and circuit will not be injured in the unloading of coal. Sockets hanging on a few inches of reinforced drop cord give better results than rigidly installed receptacles, since they are less easily broken. The use of long drops should be avoided altogether, as a rule.

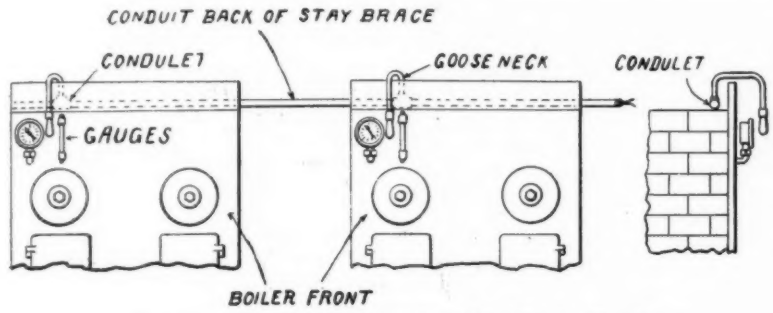


Fig. 3.—Rigid Conduit Work for Boiler-Room Circuits.

with handles should be supplied for all extension lamps, and great care should be exercised in making the splices for the sockets, as these often prove weak points. A generous coating of some insulating compound will help to make the splices waterproof. If portable electrically driven tools are to be used in the boiler room, extra-size wire and receptacles should be provided in branch circuits to which these may be attached.

If arc lamps are employed in illuminating the aisles in front of the boilers, these should be placed sufficiently high, of course, to be out of the way of slice bars and similar tools used in firing.

Motors used in a boiler room should be of the completely inclosed type, the prevalence of coal dust making this provision essential. It is the best practice, too, to install all motor starting boxes in dust-tight cabinets.

In wiring for lamps in the coal-storage bins, care must be exercised, even

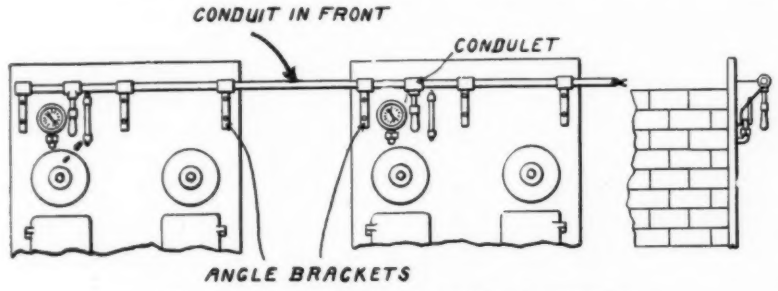


Fig. 4.—Another Type of Conduit Construction.

Here the circuit is split up and led through two meters, three No. 4 wires from one meter leading to the operating room, where the power rate is charged, and three No. 2 wires through the other meter go to the lamp distribution box, where the commercial lighting rate is charged. From this main distribution box, all the lighting for front, offices, foyer, halls and basement is controlled.

The foyer shades are rather a novelty, consisting of four panels of colored glass edged with brass and hung by hooks from a square canopy, fitting over a Russell receptacle on the conduit outlet boxes. Three of these panels are amber-colored, the fourth facing the aisles being ruby, and acting as a red exit light, while the foyer is finely lighted.

The wall brackets, 10 in number, one on each pilaster forming the panels, are of the plain square type, with green and ruby-colored cone shades, but the canopy is deepened to allow a socket to be inserted and soldered in, so that a fan can be attached to any one of these during the hot season. This does away with extra outlets and wiring for these very necessary accessories.

The ceiling is divided into five panels, each panel being adorned with two 5-lamp fixtures of special design, to allow of these lamps being used when the pictures are being shown. The two panels nearest the screen have their lamps switched off by the operator when he commences each show, the rest give a beautiful diffused light over the audience, making it a pleasure to sit there.

The operating room, a fireproof apartment 24 by 12 feet, is the finest that experience and money can furnish. The supports for the two machines and one diffusing stereopticon are one-inch pipe with flanges, fastened to floor beams before the fireproof floor is laid, and when braced at the upper end to the wall, make a rigid fastening for the machine, no shake whatever being discernible.

Three No. 4 cables enter the operating room through an L-condulet, 1.25 inch, to a switchboard, whereon all the switches under the operator's control are mounted. One 30-ampere mercury-arc rectifier, General Electric type, and two Fort Wayne compensators are connected through two double-throw switches to the machines, each arc of the stereopticon being fed through these same compensators. Two No. 4 cables feed each arc lamp from the low-voltage side of the rectifier.

This comprises one of the best laid out operating rooms that can be imagined. The house lamps being under the control of the operator by six 30-ampere knife switches on the board, he has everything required to facilitate his duties. An electric program sign under the control of the musicians, the necessary exit lamp and musicians' lamps go to make up one of the best electric installations in any theater. The architects for the work are A. & N. Melville; the electrical contractors are Stalker & Stuart. The fixtures were designed by Mr. Stalker and manufactured in Winnipeg by the Garry Manufacturing Company.

The Columbia Theater.

The city of Winnipeg, Canada, boasts of some of the finest picture theaters in North America and the latest addition to these ranks among the very best.

The front of the building, 50 feet high, has its windows, pillars, arches, etc., outlined with over 400 spherical frosted carbon lamps, and the whole is illuminated by four flaming arc lamps, suspended from ornamental brackets.

The mains are three No. 00 cables, led through the basement, where provision is made for a service from both the city and street-railway circuits, to the main distribution box in exit hall.

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The matter appearing in this section consists of questions on the National Electrical Code, its interpretation and meaning, and questions as to whether certain methods of wiring are in accord therewith. These questions are gladly received from anyone interested, even if not a member; they should be sent to the secretary with any needed elucidating sketch. They are answered by each member of the Executive Committee according to his knowledge of what the ruling would be in his jurisdiction.

It should be understood that no pretense is made to give an authoritative interpretation of the Code. This is a voluntary association; it has representation on the Electrical Committee of the National Fire Protection Association, which prepares the Code, but it has no right, and claims no right, to give a final interpretation of anything in the Code. It is only intended to give the interpretation which seems correct to the members of the Executive Committee. No attempt is made to edit or correlate the answers from the different members of the Committee.

The aim is to help toward a better understanding of the Code on the part of all; a more uniform conception of its meaning; increased precision in applying it; and harmonious action of those using it, for the common good.

Flexible Tubing in Runs Where the Wires Are Not Fished.

Question 170. Are there any rules in the National Code whereby the placing of a circuit in a slot cut out in the under side of a 2-by-4-inch crib floor, both wires being incased in continuous pieces of flexible tubing, is prohibited? After the loomed circuit is put in this slot an inch of ceiling is put over it, the loom being continuous from outlet in the ceiling on the bottom of the solid crib floor to where it enters the cabinet. Is it proper to apply Rule 16-d to a condition of this kind? Could the wires be considered as passing through timbers, or would Rule 26-r and s apply to this condition? Might it be necessary to demand rigid or flexible conduit in such a case? One would be allowed to place the circuit on the ceiling in wooden molding. What is gained by that over the plan indicated here?

Answer 1. It is apparent that this construction is located in a rather shadowy borderland.

If it forms part of a knob and tube job, I do not see why it may not be considered as fished wiring under Rule 26-*s*; it is true that possibly a nail might be driven into it, but that is a very remote possibility if the wire is pulled in after the ceiling is in place.

I much prefer it to surface molding or to a length of conduit which it might be very difficult to ground properly.

If this is part of a conduit installation, on the other hand, then, of course, it should be run in either flexible or rigid conduit, as the case may be.

Answer 2. Code Rule 26-*s* expressly allows the construction indicated if the circuit is fished in after the placing of the ceiling over the groove. This is to avoid possible damage to the loom and wires which might occur if they were laid in the slot and the cover nailed or screwed on afterward. I should prefer this construction to the use of exposed molding.

Answer 3. I know of no rule which prohibits such an installation provided it is not subject to moisture. However, I should require that the slots be large enough to allow the flexible tubing to be withdrawn if necessary, as would be the case if it were fished in. It would also be necessary to see that no nails were driven where they might go through the tubing.

Answer 4. Under the conditions described in this question, Rule 16-*d* is not, in any sense applicable. Rule 26-*s* seems to provide the only proper method of wiring in this case, for this reason: It is possible enough that no short-circuit or other electrical disaster would follow the use of circular loom or even wooden molding, but neither of these protections are, in any sense, a guarantee against carelessly driven nails; and, for that reason, B. X., or other iron protection, should be insisted upon in the conditions described in this question. It is true that wooden molding is allowed on the ceiling under the Code; and, while I believe iron conduit much better and safer construction in that case, no one in his senses would knowingly drive nails through a wooden molding in plain sight.

Answer 5. The description is not sufficiently clear to enable me to be sure of the construction in question;

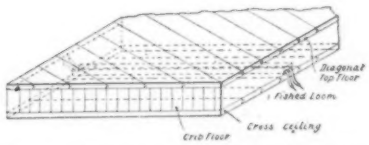


Fig. 1.—Sketch Illustrating Question 170.

but I judge it pertains to the laying of conductors separately incased in flexible tubing in wooden channels, which construction is not sanctioned by the National Electrical Code, unless under Rule 26-*s*, it could be considered "fished work" forming part of a concealed knob-and-tube system. I do not believe it could be so considered, and would suggest to the questioner that he make a cheaper and better job by using one armored cable in his solid wooden floor in place of two flexible tubes. I do not know that wooden molding has any decided advantage over the proposed flexible-tubing construction, except that it is more accessible and is always exposed to view.

Answer 6. Circular loom is not intended to be used as a conduit system, and is permitted only for fished work or as a means of securing additional insulation in knob-and-tube

work. The location cited would demand metal conduit or armored cable.

Answer 7. We know of no rule prohibiting this class of construction, provided the conditions are not subjected to moisture and that the liability of driving nails through flexible tubing and wire has been guarded against in such a manner that the inspector may assure himself that same have sustained no injury. This view might vary with the different inspectors on account of the rule in the Code stating that flexible tubing shall not be relied upon for insulating qualities but is to be used only for mechanical protection. We believe, in a way, that this rule might be construed to prohibit this class of construction.

Answer 8. This question includes the use of two kinds of installations, namely, flexible tubing and molding. Relative to the use of molding, either metal or wooden, it would not be permissible if the molding was concealed

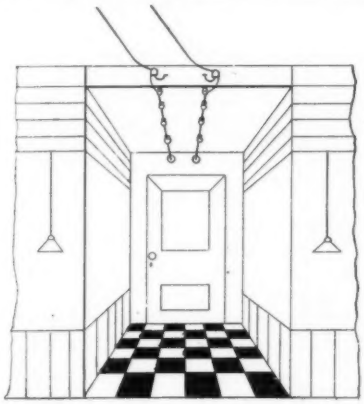


Fig. 2.—Installation Referred to in Question 171.

in the one-inch space referred to in the question. If, however, the molding was exposed on the ceiling and properly installed, the use of it would be permitted. The matter of using flexible tubing here is covered by Code Rule 26-*s*. This section has been frequently explained, and it does limit the use of flexible tubing. It would be a violation of the rule to install tubing in the manner indicated in the question. Under the circumstances, only armored cable or conduit would be permissible, according to the rule.

The Use of Porcelain Knobs on Outside Work.

Question 171. A store has two windows of plate glass with the door set back between them as shown in the sketch. A circuit of weatherproof wire comes to the glass insulators, and from there on rubber-covered wire is used, looping under the edge and running on knobs on the ceiling to door where it enters through tubes. Is this protected so that knobs are permissible as used?

Answer 1. I should rule that this wire is sufficiently protected from the weather to permit of this construction being used.

Answer 2. Yes. I should consider porcelain knobs as satisfactory insulators for use under the given conditions, which would appear to preclude all direct exposure to rain or snow.

Answer 3. This installation would be satisfactory provided the proper spacing was maintained between wires, and the knobs held the wires the required distance from the surface.

Answer 4. This construction would probably be allowed under the Code. A much better method of entering, however, would be to use conduit with condulet entrances for the wires, the whole being turned over on the street side of the door so as to form an effective drip loop.

Answer 5.—Porcelain knobs used on ceiling as shown would not be exposed to weather and are therefore acceptable.

Answer 6. I should rule that if the porcelain knobs were not exposed directly to a beating rain, the location should be considered merely as a damp one, in which case these insulators are permitted under the Code. If, on the other hand, they were exposed to the rain, I should class them as "exposed to the weather," and Rule 12-*d*, requiring petticoat insulators, would apply.

Answer 7. The method as outlined in diagram, apparently meets all requirements.

Answer 8. Reference to section *d* of Rule 12 of the National Code will show the following: "Where not exposed to the weather, low-potential wires may be supported on glass or porcelain knobs which will separate the wires at least one inch from the surface wired over, the supports to be placed at least every four and one-half feet." As shown in the illustration, which is submitted with this question, the wires are in no way exposed to the weather. This being true, the form of support shown is clearly within the intent of the rule and should be approved by inspection departments. Wherever the supports are exposed to the weather, however, they must be of the petticoat-insulated type.

Wooden Molding for Protection on Side Walls.

Question 172. Is it proper to accept wooden molding as a "mechanical protection" for conductors on side walls? (See Rule 26-e.)

Answer 1. The answer to this is that it depends on the location. In a sleeping room, for instance, it would be admissible but I should call for an iron "kick-plate" at the floor. In a hallway where furniture or other things might strike it while being carried by, I should object to the use of molding as not having sufficient mechanical strength.

Answer 2. Not where the wires are "exposed to mechanical injury"; see Rule 26-*e* which prescribes either a *substantial* boxing with one-inch air space, etc., or approved conduit or pipe of equivalent strength. Molding, either wood or metal, on side walls, would be allowable only where conditions are such as to indicate no unusual exposure to injury.

Answer 3. In some cases, as in residences and offices where it would not be apt to be mechanically injured, molding would be acceptable.

Answer 4. It depends entirely upon the use to which the room in which the wiring is located is put. An approved wooden molding with the proper "kick-plate" at the bottom might be acceptable in a room used for light work; in a place where heavy castings, or other bulky articles are used, or where a molding would be likely to be subjected to a severe blow, iron conduit should be insisted upon.

Answer 5. Rule 26-*e* requires that "wires must where exposed to mechanical injury be suitably protected." If the wires are inclosed in wooden molding on a side wall, they may or may not be exposed to injury, according to the location. In dwellings for instance they would ordinarily not need any further protection, but in some cases a guard strip on each side of the molding is desirable to protect the molding itself from injury. In mercantile buildings, warehouses or factories wooden boxing or metal pipes should be used.

Answer 6. Whether wooden molding is a proper mechanical protection for conductors on side walls must be determined by local conditions. In an office there would ordinarily be no objection to such construction, while in a dark, narrow hallway, or in shipping room of some business house, wooden molding would probably be damaged

in very short order. In answering this question the severity of the anticipated mechanical strain is the controlling factor.

Answer 7. In a general way, we do not believe wooden molding adequate for mechanical protection on side walls. Code Rule 26-*e* furnishes us with details for this class of work. In places where molding is not subjected to abuse or the liability of serious mechanical injury, we believe that it would be preferable to breaking the continuity in complying with the rule referred to.

Answer 8. Under all conditions, I do not think wooden molding is a suitable protection against mechanical injury for wires on a side wall. In a warehouse, for example, where boxes and barrels are stored, wooden molding would last but a short time. The better plan would be to inclose the wires in a suitable boxing or in conduit.

Electrolytic Process for Lead Coating.

A new process has been introduced by Sherard Cowper-Coles, of London, England, for coating metallic surfaces with lead to any desired thickness. The process is an electrolytic one, and has the advantage that it is very rapid, and therefore the plant required for a given output is comparatively small; also the power required to deposit a ton of lead is very small compared to other metals, such as copper and zinc. Hitherto the coating of iron and steel surfaces with lead has been almost exclusively confined to the production of terne-plate, as the thickness of lead which can be applied is within narrow limits. The process at present in use consists of dipping the sheets into molten lead, to which, in some cases, a small percentage of tin is added. The new process opens up a large field of applications enabling lead coatings to be applied to a variety of purposes, such as the coating of iron pipes inside or outside, or inside only, for the conveyance of corrosive liquids. The application of this process to fittings for storage-battery work opens an important field. One advantage of the process is that the surface is smoother than that obtained by older processes. The process can be used for coating earthenware and wood with lead.

Compulsory Wireless on Spanish Vessels.

There has been issued by the Minister of Marine at Madrid a circular emphasizing the necessity of Spanish mercantile vessels being fitted with wireless-telegraph apparatus. Reference is made to the laws and regulations already in force in Austria, Italy, and the United States. The General Association of Shipowners has urged the Government to take action in the matter, the view being that wireless telegraphy is essential to shipping. Accordingly a royal decree has been issued requiring all mercantile ships to be fitted by August 1, 1912. Penalties are provided for failure to comply therewith.

Large German Wireless Station.

The German Wireless Telegraph Company has completed arrangements for the erection of a series of seven gigantic wireless towers near Kiel. When completed these will comprise the largest wireless station in the world. Each tower will be 500 feet high. Three of the towers will be completed next summer and four others later. The equipment of the station will be very powerful.

Public Service Commissions

NEW YORK.

G. V. S. Williams, of Brooklyn, counsel to the State Conservation Commission, will succeed Commissioner William McCarroll on the Public Service Commission, First District.

The Commission granted permission to the New York Edison Company to put into effect April 1, without the customary notice, a new tariff for tungsten lamps. The new tariff makes material reductions in the prices charged for such lamps.

The Public Service Commission, Second District, has dismissed the petition of the Fredonia Natural Gas Light Company asking for permission of the Commission to suspend the manufacture of illuminating gas for service in the village of Fredonia, Chautauqua County. The petition stated that at the present time it was selling manufactured gas at an income of less than $25 a month and the cost of manufacture is about $300 a month, and because of the use of natural gas, customers have almost entirely fallen off. The petition is denied for the reason that under the statute the Commission has no jurisdiction over such an application.

The Commission has authorized the Patchogue Electric Light Company to exercise franchises in the town of Southampton, Suffolk County.

The Commission issued an order in 1911 requiring all corporations and municipalities to stencil and number their poles. A hearing was thereafter held and corporations were given until January 1, 1912, to file modifications, suggestions and criticisms of this order. On March 8, 1912, a final order was issued requiring that such stenciling be completed before January 1, 1913. The order covers poles, towers or other structures for supporting overhead electric wires or electric lamps. Where two or more companies jointly own any such structure, a distinguishing mark of each company shall be placed on it, but only one number is required. Where a double line of structures exists, as for overhead trolley wires, the stencil need be affixed to but one line. Where structures constitute a through line outside of towns it is sufficient to stencil every fifth structure. Corporations are required to file with the Commission by May 1, 1912, a statement showing the initials, abbreviation or other distinguishing symbol to be used, the means of stenciling to be employed (whether paint, metal tags, etc.), and the method to be followed in numbering.

The Public Service Commission, Second District, has authorized the Union Springs Light and Power Company to exercise franchises granted by the village of Union Springs, Cayuga County, for operating an electric light plant. The Commission has authorized the Orange County Traction Company to issue its 5.5 per-cent equipment trust certificates to the par value of $48,000. The proceeds are to be used for the purchase of eight single-truck, four double-truck and four dump cars, for use on the lines of that company.

WISCONSIN.

The Commission has ordered the Wisconsin Electric Railway Company to rearrange its fare zones on its interurban line between Neenah and Oshkosh.

Revision of National Electrical Code.

The Electrical Committee of the National Fire Protection Association met in Boston on March 27. This being the Committee whose duty it is to revise and amend the National Electrical Code when revisions and amendments are necessary, its deliberations are of very great interest and importance to the entire electrical industry and to the general public as well. At the recent meeting in Boston, certain changes in a number of Code rules were considered carefully, some of these adopted and others referred to committees for still further consideration. These revisions are noted in the following paragraphs.

One of the most interesting matters before the Committee was the proposed revision of Rule 15 of the Code, which rule, it will be recalled, refers to the matter of the grounding of low-potential circuits. A special Committee representing the American Institute of Electrical Engineers, the Association of Edison Illuminating Companies, the National Electrical Inspectors' Association and the National Electric Light Association reported to the convention that a conference was held in New York on March 12 at which this special committee decided unanimously to recommend to the Electrical Committee of the National Fire Protection Association that sections *a* and *b* of Rule 15 be modified and amended, the proposed changes being specifically incorporated in the report.

After full discussion of the report, th convention decided that the first paragraph of Rule 15*a* should read "*a*. Neutral wire must" (instead of may) "be grounded," and that the rest of the section should remain unchanged down to the two paragraphs in fine print, the first one of which begins "Inspection Departments having jurisdiction—", and that these two paragraphs should be omitted.

From Rule 15*b* the paragraph in fine print which says "Inspection Departments having jurisdiction may *require* grounding if they deem it necessary", was omitted. Paragraph 2 of Rule 15*b* was changed to read "When no neutral point or wire is accessible, one side of the secondary circuit must be grounded," the rest of the paragraph as it now stands in the Code being stricken out.

A new paragraph to be known as Rule 15*b*-4, and to read as follows, was inserted: "Where the maximum difference of potential between the grounded point and any other point in the circuit exceeds 150 volts, grounding may be permitted."

A fine-print paragraph was added after section *g* of Rule 15, which reads: "Companies and departments in charge of water-works are urged to allow the attaching of ground wires to their piping systems in the full confidence that the integrity of such piping will in no way be affected, whatever be the normal voltage."

The Committee decided not to make the foregoing changes in Rule 15 mandatory now. Their adoption will be allowed in any locality where it is desired, but it will not be attempted to enforce the adoption until the next convention of the National Fire Protection Association has indorsed the changes.

Rule 2*b* of the Code was referred to a committee whose duty it is to make the section clearer and more specific than it now is.

As to Rule 12*f*, the suggestion was made that it be changed so as to require all conduit services to be fused outside the building or else to be brought in clear of combustible material. This matter was referred to the Committee on the Insulation of Service Wires.

A suggestion to make further revisions in Rule 15 so as to specify grounds in terms of the current-carrying capacity and the resistance of the ground was referred to a special committee.

That part of Rule 23*d* beginning "All branches or taps" is to be reworded so as to make it clearer.

It was suggested that Rule 38 be changed so as to apply also to cases where a moving-picture machine is used in homes or other places. As the rule is worded in the 1911 edition of the Code, it can be construed as applying only to "theaters and moving-picture establishments."

It was decided to change item 6 of Rule 38*u* so that "motion-picture machines especially approved for motor operation may be permitted by inspection departments having jurisdiction." This, of course, is a revision of the present statement in the Code that the use of motor-driven motion-picture machines will not be permitted at all. It only means, however, that such machines as are approved for motor drive by the Underwriters' Laboratories may be used.

A proposal to change Rule 47 so as to permit the use of three-phase Y-connected systems with a grounded neutral where there is not over 2,500 volts pressure between the neutral and each one of the three wires was referred to a committee to be appointed by the chairman.

Rule 70*a*, the last paragraph of it, was changed to read "Cabinets must be deep enough to allow the door to be closed when the switches are thrown open as far as their construction and installation will permit."

Rule 83*b* was changed, by the omission of the comma after "transformers" in the first line of the third paragraph, to permit the installation of sign-lighting transformers of the weatherproof type out of doors.

That part of Rule 83*e*, on page 160 of the Code, which begins "In those parts of circuits" is to form a separate paragraph.

Rule 85*e* was changed so as to make it clear that both wires of the signal circuit may enter the building through the same bushing.

Rule 56*c* was modified so as to require a one-thirty-second-inch braid on concentric wire as well as on single wires used in conduit.

To Rule 65, a new chapter was added covering the marking of knife switches. The tables of spacings are to be numbered and designated so as to permit accurate reference to them.

Concerning Rule 67*j*, the Committee refused to consider the addition of a spacing which would permit the use of link fuses, on voltages exceeding 250.

Rule 50*j* was reworded to permit the lead covering of duplex wire to be of a thickness calculated on the basis of the single wire rather than on that of the combined diameter of the two wires.

The matter set in bold-face type in Rule 85*a* is to be reworded, and the marine rules are also to be reworded by a committee appointed for the purpose.

Electrical Inspection.

A bill has passed both houses in New Jersey providing that when cities in that State provide by ordinance for the regulation and inspection of electrical wires, etc., it shall be unlawful for insurance companies to charge for such inspections.

Another English Railroad to Electrify.

The London & Southwestern Railway has decided to electrify a portion of its suburban lines. The company has decided on the overhead system of electrification, which has proved so successful on the London, Brighton and South Coast Railway, and the work will be proceeded with immediately.

Low Corona Loss.

According to the *Elektrotechnische Zeitschrift*, the 30-mile transmission line of the Lauchhammer Gesellschaft, near Dresden, Germany, shows a corona loss only from one-fifth to one-sixth of that measured on American 110,000-volt lines.

Wireless as a News Carrier.

For the last three months the New York *Times* has been receiving practically all of its daily foreign news service by wireless telegraphy. This service often comprises more than 2,000 words daily, and 8,000 or more for Sunday, approximating some 20,000 words a week. Wireless as a means of communication between the new world and the old, according to the *Times*, has been found almost, if not quite, as rapid as transmission by cable, and on the whole as reliable. The average time of dispatches for daily service has been from about one hour and fifteen minutes to three hours. For as long as a week at a time the wireless has not been relieved by even a single cable message.

The best time for a news dispatch, so far, has been twenty minutes for a Berlin dispatch from London to New York Saturday night, March 16. This was exactly one-third of the time consumed in sending the same dispatch from Berlin to London—not by wireless. Another dispatch, from Paris, came through on the same evening, when conditions were unusually favorable, in twenty-one minutes. This dispatch had been telephoned from Paris to London. The telephoning began at 1 o'clock (London time) on Sunday morning in Paris, the message started from London to Clifden, Ireland, by land wire, at 1:20 o'clock, and at 8:41 o'clock on Saturday night (New York time) it was being read in Times Square, New York, having thus completed its journey from Paris by telephone, telegraph and wireless in 41 minutes. A dispatch from Rome to the *Times* reached New York from London in 43 minutes.

Conditions for rapid transmission, it must be admitted, were unsually favorable. Signor Marconi, the inventor, and Godfrey Isaacs, chairman of the board of directors of the British Marconi Company, had reached New York for a short visit the day before, and a dinner in their honor was being given by the editors of the *Times* in the banquet hall of the Times Building. A number of messages of congratulation to Marconi from leading British statesmen, scientists and journalists on the success of his system of communication had been written for transmission to him at the dinner and the aid of the British Postmaster General had been invoked for a clear way for these messages on the British land lines, on which the delays in transit of trans-Atlantic wireless messages had usually occurred. This aid had been willingly granted, as had that of the Western Union Telegraph Company on the land lines between Glace Bay, the Marconi Canadian station, and New York, on this side of the ocean. The result was a remarkable series of new records in trans-Atlantic wireless transmission. Two of the British messages were received in the *Times* office ten minutes after they were despatched from London. The time consumed by five of the messages is best shown in the following table:

Sender	Filed in London	Received at Clifden	Sent from Clifden	Received at Glace Bay	Received by New York Times	Time from London to New York
Earl Grey	11:50 P.M.	12:08 A.M.	12:10 A.M.	8:10 P.M.	7:10 P.M.	20 Min.
Lord Avebury	12:00 M.	12:18 A.M.	12:20 A.M.	8:20 P.M.	7:22 P.M.	22 Min.
Lord Blythe	12:15 A.M.	12:19 A.M.	12:22 A.M.	8:25 P.M.	7:25 P.M.	10 Min.
Sir Rufus Issacs	12:20 A.M.	12:30 A.M.	12:33 A.M.	8:33 P.M.	7:34 P.M.	14 Min.
Hon. Harry Lawson	12:30 A.M.	12:32 A.M.	12:37 A.M.	8:40 P.M.	7:40 P.M.	10 Min.

The messages, as is here shown, were relayed twice: from the British land lines to the wireless station at Clifden, and from the wireless to the land lines at Glace Bay, Newfoundland. It will be noted also that the time of transmission in several of the messages would have been better had one message not followed immediately after the other. Thus, the message from Hon. Harry Lawson arrived at Clifden at 12:32, one minute before the previous message from Sir Rufus Isaacs, received there at 12:30 and sent on by wireless at 12:33 was out of the way, and it therefore lost several minutes waiting for the Lawson message to end.

Nevertheless, the messages made new records in wireless transmission across the Atlantic and demonstrated that only improved co-operation with the land lines or an extension of wireless system over land as well as sea on both sides of the ocean is necessary for almost instantaneous communication.

The New York *Times*, which has led its contemporaries in the use of wireless telegraphy, first tried the system some four years ago for transmission of Sunday European articles of a semi-news character which would have been costly to cable at great length, but for which the mails would have been far too slow. Observance of the speed at which they were carried led gradually to the extension of this service to actual news dispatches, sometimes it has been rumored, in face of the apprehensions of the conservative Marconi managers, who feared lest the new system then only just past the experimental stage might not stand the test. It was only three months ago, however, that the *Times* undertook the daring experiment of a full foreign service by wireless, with the most satisfactory results.

Many of the *Times'* despatches are now telephoned by the people's correspondents in Paris and Berlin, as well as by its correspondents in different parts of the United Kingdom to the chief office in London, where they are skeletonized and committed to the land lines for for wireless transmission to New York. The opening of a wireless station at Coltano, Italy, of another wireless station near Madrid, in Spain, and the extension of the wireless system under the auspices of the British government, to other parts of the empire, has greatly increased the field of its usefulness as a conveyor of news, and should the company's plans for the installation of other and more powerful stations nearer London and New York mature, its development as a news carrier will be one of the most remarkable events of the present decade.

Experimental Wireless Station.

A new wireless station for experimental work is being erected on the sea front at Gloucester, Mass., by John H. Hammond, Jr. It will be one of the most complete experimental stations for wireless purposes in existence. The aerial will be supported by two towers 340 feet high and 350 feet apart. The power installation will comprise eight complete wireless systems and also a system for telephoning over a searchlight beam. Two two-kilowatt generators, each giving 100,000 cycles, will be provided and used for developments in wireless telephony. There will also be generators for providing lower frequencies for telegraph work and a direct-current generating set for use with arc telephony. Among other things, the station will be used for experiments on the control of wireless dirigible torpedos.

Preceded Morse as a Telegrapher.

David Alter, of Freeport, Pa., is credited with having preceded Morse as the inventor of the telegraph, in a paper read by W. J. Holland, director of the Carnegie Museum, of Pittsburgh, before the Academy of Natural Sciences in Philadelphia, recently. Dr. Alter was a physician of inquiring and ingenious mind, said the speaker, "who was early in life attracted to the study of electricity and chemistry, having as a boy read the story of Franklin, and who, quite independently and yet in fact before the discovery of Morse invented a crude system of telegraphing.

"There was no connection between himself and Morse, and Dr. Alter was most emphatic in disclaiming any credit for the introduction of the telegraphic apparatus which the genius of Morse involved."

The New Street-Lighting System for Chicago.

Some pertinent facts relative to the new street-lighting system for Chicago were set forth by Hans Schaedlich in an address before the Electric Club of Chicago, on March 28. The city has entered into a contract with the Sanitary District whereby it will supply energy for a new installation comprising 10,000 flaming arc lamps. At present the new lamps will be installed on the posts now in use, suspended 20 feet from the sidewalk, but the plans call for the replacement of the old posts ultimately. The height at which the lamps are now being installed will also be subject to change, due principally to the action of the Illuminating Engineering Society in advocating a greater height.

The final selection of flaming arc lamps was made after a six-months' test on various illuminants conducted by the Electrical Department of the city. Mr. Schaedlich stated that this test indicated that with a slightly greater current consumption, the flaming arc lamps would produce from 2,000 to 2,500 candlepower as compared with 200 candlepower given by the old open arcs now in use. The 10,000 lamps provided for under the present contract will be installed in the territory bounded on the south by Seventy-first Street and on the north by the city limits. Mr. Schaedlich said that should the Sanitary District succeed in its efforts to obtain additional flow from Lake Michigan, the city would ultimately contract for more lamps.

Standard overhead construction will be employed except in cases where property owners desire to pay the additional cost of underground construction.

In reply to questions of F. H. Bernhard Mr. Schaedlich said that maintenance cost of tungsten lamps was too high to admit of their being installed in the residence districts. Owing to the great area to be lighted the cost per lamp must be kept low. On streets where underground construction is employed the posts will be staggered, on other streets posts will be placed on one side only. Regarding life of carbons, an average of 132 hours is expected.

George C. Keech spoke briefly of the action taken by the Illuminating Engineering Society Committee, of which he is a member, relative to height of lamps. It was found by the Committee after comparing the effects of lamps suspended at both the 20-foot and 30-foot heights, that the glare from lamps at the 20-foot suspension was decidedly objectionable.

W. E. Keily asked Mr. Schaedlich what method of trimming lamps will be employed. The speaker stated that no special features have been decided upon. He added that the local lamp-trimmers' union objected to climbing over 20 feet for trimming and this entered into the determination of the height of lamps.

Harold B. Barnes, electrical contractor of Denver, described briefly the street-lighting system in Denver. In the business district trolley poles are utilized and 3.5-ampere inclosed arc lamps are suspended from these. There are 2,000 of these in service. For trimmind these lamps an automobile tower wagon, as used in Philadelphia, will be employed. In residence districts magnetite arcs are employed. Mr. Barnes stated that flaming arcs were tested but it was found necessary to inclose them in double globes on account of the glare. In parks and along boulevards 50-watt series tungstens are installed. Some concrete and some iron post are used, the lamps being 12 feet high and the posts 60 feet apart. Opalescent globes are employed. In the outlying districts also, series tungstens are used. Mr. Barnes stated that the life of these lamps was from 3,000 to 4,000 hours.

William M. Connelly, secretary, presided in the absence of President Gray.

An informal reception and dance was held on Monday evening, April 1, in the Drill Hall of the Masonic Temple. About 100 members and guests attended and all voted the affair a marked success. Music was furnished by Peters Orchestra.

Defeat of Municipal Ownership at South Framingham.

Municipal ownership was defeated at South Framingham, Mass., on March 19 at an adjourned town meeting, after a campaign which has lasted upwards of six years. The Edison Electric Illuminating Company of Boston supplies the town with service, and for the past two years a committee of citizens has been endeavoring to commit the municipality to the project of establishing a town plant and distribution system. The voters decided to authorize the selectmen to make a 10-year street-lighting contract with the company.

Under the Massachusetts law it is necessary for a town to cast a two-thirds vote in favor of municipal ownership at two elections not less than three months nor more than two years apart, in order to establish a municipal system.

Pension System for the Western Union.

The Western Union Telegraph Company has worked out a pension system for the benefit of its employees. It differs from most of those now in vogue in providing a sliding scale which increases the pension according to the length of service. The minimum allowance is $25 a month.

Permanent Patent Exhibitions.

A permanent patent exhibition has been opened in Dresden, Germany, for the purpose of giving publicity to recent discoveries, patents and new products. Manufacturers, capitalists, merchants, purchasing agents and others will be especially invited to this exhibition, so that it should offer excellent opportunities for creating a market for the new inventions. The industries of Saxony are highly developed and are in the front rank in the use of modern methods, practical novelties and new discoveries, so that inventors should find it worth while to place their novelties on exhibition. Models of patented outsides, drawings, copies of patents and descriptions of articles will all be acceptable for exhibition, and no charge is made for a temporary exhibit of six weeks. The address of the organization which has this exhibition in charge is "Merkur," Webergasse 29, Dresden, Germany.

In London, England, a similar permanent exhibition is being arranged where inventors will have the opportunity of displaying their patents. Expert demonstrators will be employed to show visitors through the various sections of the exhibition. It is hoped that this will put inventors of useful patents in touch with investors, and thus help them to profitably dispose of their inventions.

Coal Strike Increases Demand for Electric Power.

One result of the coal strike in England is a big increase in the demand for electric power. Applications for service in London have increased by 100 to 200 per cent, and the electric companies are reaping big advantages. In addition to the scarcity of coal the the price of oil is very high. Most of the central stations have a much larger supply of coal on hand than the manufacturers and are consequently able to furnish the latter with power.

Meeting of the Ohio Society of Engineers.

The Ohio Society of Mechanical, Electrical and Steam Engineers will hold a convention in Pittsburgh, Pa., on May 16, 17 and 18. An attendance of about 150 is expected. A local entertainment committee, consisting of A. A. Anderson, A. W. Dodds, J. E. Whittlesley and W. R. McCord, is making active preparations for the meeting.

March Meeting of Electric Vehicle Association of America.

The March meeting of the Electric Vehicle Association of America was held in the Engineering Societies Building, New York, N. Y., on the evening of March 26, the usual large attendance being on hand. W. H. Blood, Jr., occupied the chair.

The paper of the evening was entitled, "Efficient Charging of Electric Automobile Batteries," and was presented by the author, J. F. Lincoln, of Cleveland. The following is an abstract of Mr. Lincoln's paper.

Efficient Charging of Vehicle Batteries.

The efficient charging of electric batteries for automobile purposes in the usual garage is very much complicated because of the following reasons: (1) the batteries in the cars which are now in actual operation require a voltage which on the smallest number of cells is 30 and on the largest number of cells about 120. Practically all the intermediate voltages are needed. (2) The rates at which these batteries are to be charged on the usual passenger or pleasure vehicle will vary from 15 to 60 amperes. The usual method of taking care of these different voltages is to get a single voltage, usually 125, which will certainly be high enough to charge any of the batteries, and then by the use of a rheostat reduce this voltage to the voltage that the battery requires. The great drawbacks to this scheme are the fact that there is a loss in the rheostat varying from 5 per cent to 80 per cent and there is also no chance for the battery to get a tapering charge unless closely watched by the operator, and since the tapering charge on the lead batteries is indispensable for the best operation of the battery it usually means that the life of the battery and its mileage is very rapidly decreased. The problem, then, of the garage operator is to eliminate as much as possible the loss which is found in this class of work with the single voltage system mentioned above, and, also, if possible, arrange so that a tapering charge can be gotten. With the mercury-arc rectifier it is necessary, of course, to charge cars in series, this series sometimes being as high as five cars on a line. This system, of course, is just that much more destructive than having two in series, since it is commercially impossible to get five cars which are like enough in their discharge so that the charging rate on all five cars can be made the same without harm to one or more of them. The ideal charging system in the garages similar to those to be found in large cities where electric passenger or pleasure cars are found, would, on account of the wide diversity of voltages required, have to deliver a multiplicity of voltages, these voltages to be but very little higher than the maximum charging voltage for the battery. In series with the battery there should be placed a small ohmic resistance which will automatically cause the charging rate to decrease as the charge goes on, consequent on the rising voltage of the battery. It will also be necessary to have this rheostat so arranged that any rate can be given the battery from 5 to 60 amperes without danger to the rheostat. It would also be necessary for the best practical operation to be able to read at one or more central panels the state of charge and rate of charge of each battery in circuit. With an outfit such as this, the smallest possible amount of power will be wasted, thus giving the greatest possible efficiency. To fulfill these requirements there is now on the market apparatus especially adapted to this work. The apparatus is, primarily, a motor-generator set, the generator giving two voltages, one of them being 105 and the other 70. Direct-connected to this generator is a small double-commutator booster whose fields are excited from the 105-volt generator, thus giving it a constant excitation, two windings on the armature being so arranged that when turning at the speed of the motor generator set they will deliver 5 volts. With this outfit it will be possible to add to or subtract from the voltage of the main generator this 5 volts. In this way the voltages actually given will be 65, 70, 75 and 80, also 100, 105, 110 and 115. Another feature of importance is the fact that positive or negative boost from this small booster will be taken from opposite sides, that is, from one side in the case of the 105-volt commutator, and from the other side in the case of the 70-volt commutator, so that the size of the small booster can be made very small in comparison with the size of the main generator.

It will, therefore, be plain that with this charging outfit mentioned, all of the usual batteries now in operation can be charged direct from this multiple voltage system without a loss which will exceed a maximum of 5 volts and which in actual practice will have an average of considerably less than 2 volts. This means a saving of from 2 to 60 per cent over the single-voltage system. Some comparative cost figures were given.

Mr. Harris, of the New York Edison Company opened the discussion. He thought that with the great variety of batteries in use, the scheme proposed by Mr. Lincoln was a very efficient, although he questioned the necessity for so many different numbers of cells in various batteries. He also exhibited a curve showing the efficiency of the mercury-arc rectifier in charging service.

Mr. Scheff favored the multiple-voltage system but thought that two motor-generator sets, each of equal capacity and with total capacity to take care of the needs of the garage, would be preferable to the system advocated by Mr. Lincoln. With the former, Mr. Scheff said, each direct-current machine would be capable of having its voltage vary for 60 to 125 through field regulation and deliver its full-load current throughout that range.

Mr. Russell spoke in favor of mercury-arc rectifiers and cited instances of long tube life. He said that in Gimbel Brothers garage, in New York, there are 35 rectifiers installed. The average life of tubes here is 900 hours.

Mr. Lloyd advocated the adoption of the 44-cell and 60-cell batteries and 115 volts on the line.

Mr. Maxwell spoke of the efficiency of the rectifier over a very wide range, which makes it particularly adaptable for charging a variety of batteries from 20 odd cells up to 44 without any important difference in efficiency. In large garages motor-generator sets with some special means of control should be used.

Bismuth.

Bismuth is one of the few metals of which the United States can not or does not produce enough to supply its needs. The scarcity of bismuth in this country and the accredited control of the market by a foreign syndicate have kept the American price high, but according to the United States Geological Survey interest is rapidly being developed in the recovery of bismuth as a by-product in electrolytic lead refining. No large deposits of bismuth are known in the United States, but some ores mined for their gold or silver have been found to be more valuable for their bismuth than for their other mineral content.

The imports of bismuth in 1910 were 198,174 pounds, valued at $332,668.

A Large Electric Kitchen in London.

The Borough of Marylebone electricity department has been noted in England for several years past for the completeness and aggressiveness of its business-getting department. Its activities have brought it into collision with electrical contracting firms in the district again and again, but whatever be the merits of the question, Marylebone, under the guidance of A. Hugh Seabrook, the general manager, has shown admirable spirit in trying to educate and win the residents as consumers of electricity. It was one of the first London electric supply authorities to open a permanent showroom for electric light, heat, and small-power apparatus, and it has now on its circuits the finest electric kitchen in the United Kingdom. By courtesy of Mr. Seabrook we are enabled to present the following particulars of this kitchen.

It is intended to make full use of this example as part of a bold effort at this early stage of electric cooking, to prevent the public from being deluded into the belief that it is expensive as compared with other systems. The kitchen at Marylebone Lane has been established purely as a *commercial* undertaking. It is not a case of catering for the wealthy and luxurious classes to whom hygiene, cleanliness, flavor and other factors are of more importance than mere cost—it is to cook food for the staff and employees of one of the largest London business houses and not for its customers. It is run by M. H. Clinch, the manager of the London Home Delicacies Association, and "after some months of successful working . . . the cost of electricity used is—as stated by Mr. Clinch, who pays the bill—lower than the cost of doing the cooking by the old methods." The whole of the equipment was supplied by the British Promethus Company of Birmingham, and it was installed by the constructional staff of the Saint Marylebone Electric Supply Department, which also supplies the electricity. The apparatus is as follows:

Seven electric ovens 24 inches wide, 26 inches high and 21 inches deep. Two small hot cupboards 19.5 inches wide, 24.5 inches high and 22 inches deep. One large hot cupboard 9 feet 6 inches long, 14 inches high and 21 inches deep. One hot cupboard in dining hall with six shelves for warming dinners of those employees who prefer to bring their own food, each of the six spaces being 7 inches high, 26 inches wide and 15 inches deep. Two hot cupboards 40 inches long, 23 inches high and 23 inches deep, in the serving room, with carving tables on top. Three tea urns, each of four gallons' capacity. Two electric steam boilers,

supplying steam to four large vegetable steamers at 15 pounds pressure, the steamers being capable of cooking 400 to 500 pounds of potatoes per hour. Four boilers for cooking meat, puddings, vegetables, etc., also fitted with steaming tops for cooking with saturated steam. One boiling pan is fitted with heavy, tinned-copper interior vessel to form a *bain marie* for cooking custards, sauces, etc. One hot plate 36 inches by 18 inches for boiling and simmering stews, gravies, custards, etc

Electrical Fish Fryer.

Other makers of apparatus have supplied one electric grill 23 inches by 12 inches, and one large fish fryer 24 inches by 24 inches and 4.75 inches deep, capable of frying 300 to 400 pieces of fish per hour.

The London Home Delicacies Association is probably the largest contractor for staff-feeding in London, for in the aggregate it supplies meals for over 5,000 persons per day, a circumstance which puts it in possession of experience which makes it thoroughly capable of appreciating the advantages and disadvantages, costs and economies, of various methods of cooking and catering. Mr. Clinch's testimony is one worth quoting. He says that when embarking upon the change to electricity, he was somewhat doubtful what the results would be, and although he and the company welcomed the experience, they expected trouble with regard to both reliability and cost. Therefore these points were most carefully watched. As to reliability they now say that after more than six months' working nothing whatever has happened to stop cooking operations. "The way the installation is fitted prevents such an occurrence, and we are satisfied that the apparatus is as reliable as anyone could wish." In regard to cost I again quote his words: "Before the kitchen was fully equipped and before any cooking was started, our estimate for the cost of current for cooking was made out. We were informed that the cost would not exceed the cost of gas cooking for a similar installation and our estimate was made accordingly. The actual cost of electricity used in practice—and we have now had six months' steady working—proves to be lower than our estimate even at the price of two cents per kilowatt-hour, and we are satisfied that it would not be possible to work this kitchen, taking all things into consideration, at a less cost by using coal or gas as the heating agent."

The saving in weight of meat cooked in the electric oven is found to be "approximately one pound in twelve pounds." Mr. Clinch adds: "This saving, turned into pounds, shillings and pence, represents quite an appreciable proportion of the cost of cooking."

The apparatus is under perfect control by means of the switches provided. The indicating lamps (the lamps light up as each switch is put on) serve to constantly remind the cooks that the ovens are being used at certain temperatures.

"They, consequently, do not forget to lower the heat when required, with the result that the food cooked is very rarely spoilt by inattention at their hands." We quote one more interesting statement made by Mr. Clinch: "During a recent visit to the United States, I found that the best caterers had not been slow to realize the benefits of electric cooking. Installations quite as large as that in Marylebone Lane have been designed, are being built and have been finished for supplying large quantities of cooked food. The largest one that came under my notice (cooking for 5,000 persons per day) is part of the kitchen equipment of the keenest commercial caterers in America. The fact that this particular firm adopted electricity for its work is sufficient in itself to convince those who know the firm's business methods that electrical cooking has come to stay."

In most parts of the United Kingdom there is in progress a strong movement to boom electric cooking by electric supply managers and their commercial-development staff, as well as by manufacturers, who in certain instances are running popularizing campaigns of their own.

There is another large electric kitchen just completed in the Marylebone area of supply, namely, at the London Polytechnic in Regent Street. Here also the equipment was put in and electricity is being supplied by Mr. Seabrook's department, but the installation has not yet been at work long enough for cost data to be quoted.

Power-Site Reserves Created.

Power-site reserves embracing 28,147 acres were created during February, in California, Colorado, Idaho, Montana, and Utah, as a result of investigations and recommendations by the United States Geological Survey. These lands are withheld from public entry pending proposed legislation by Congress which shall provide for the manner of their development.

CARBON-PLATE RHEOSTATS.

By Charles R. Moore.

The successful handling of commercial and test electrical circuits usually requires the use of some form of resistance. These resistances are made in various ways and are generally known as rheostats.

It is well known that all materials offer a resistance to the flow of electricity through them, and that to transmit electricity from the source of electromotive force to the apparatus utilizing the electrical energy, an extra electromotive force is required to force the current through the transmission conductors themselves. This means that if a definite voltage is desired at the receiving end of a line, an initial

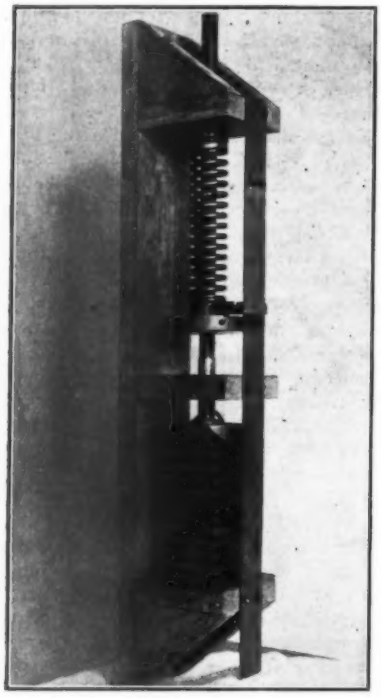


Fig. 1.—Carbon Rheostat.

electromotive force larger than that needed by the receiving apparatus must be generated. This difference in voltage represents a loss and therefore materials of high conductivity are used for transmission work. On the other hand it may be desired to regulate the voltage supply, without altering the generated voltage, as for instance in test circuits using as a source of electromotive force a generator supplying lamps. To effect such regulation, resistances made up of some material of low conductivity may be inserted in the circuit, thus making use of the loss in voltage above referred to.

Another well known phenomenon is the variation of contact resistance with pressure and to a certain extent with current density. This principle is made use of in telephone transmitters, where the variation of pressure on the diaphragm, caused by the sound, gives rise to undulating currents in the talking circuit.

In recent years this principle has been applied to power apparatus so that at the present time contact-resistance rheostats are of considerable commercial importance. The material universally used in apparatus operating upon this principle is carbon, either in the form of granules, balls, etc., or flat disks.

All rheostats may therefore be divided into two general classes: (*a*) those whose resistive power is a function of the specific resistance of the materials carrying the current; (*b*) those whose resistive power is a function of the contact resistance between the current-carrying sections making up the rheostat.

Much has already been published concerning class (*a*) and resistance units composed of some conductor of low conductivity such as iron, German silver, etc., may now be designed with considerable accuracy. As much can hardly be said, however, concerning class (*b*). So far as the writer is aware, but little has been published, having to do with the design of carbon-plate rheostats.

With this idea in mind the author began a series of experiments a few years ago the results of which supply data for the design of such apparatus.

Carbon disks, both round and square, varying in thickness from an eighth to a quarter inch were tested. The tests consisted of stacking the plates in a frame, at one end of which was placed a screw working against a spring. This spring was arranged with a pointer and calibrated so that the force in pounds could be read from a scale. Each carbon pile tested consisted of two sizes of plates stacked alternately as shown in Fig. 1. The circuit was arranged as shown in Fig. 2, and readings of voltage, current, temperature, and pressure were taken. Separate tests were made by keeping each of the three items, current, pressure, and voltage constant, allowing the other three quantities to vary.

The results plot as shown in Figs. 3 and 4, Fig. 3 being in terms of watts per square inch per contact, and Fig. 4 in terms of ohms per square inch per contact, both plotted against pressure in pounds per square inch as ordinates.

Deductions from these tests show that the radiating coefficient varies from 0.002 to 0.005 watts per square inch per degree rise for the horizontal position, with an average of 0.0043 with the plates in a vertical position. An average value for this coefficient for all positions may be taken at 0.003 watts per square inch per degree centigrade rise.

The temperature rise attained in these tests ranged from 85 to 40 degrees centigrade, depending upon the energy dissipated and the size of the plates tested. The plates one-eighth of an inch to three-sixteenths of an inch in thickness gave more uniform results, owing propably to better contact between the plates.

It will be noted that in rheostats of this character the operation is a question of watts rather than of resistance only. The variation in resistance is continuous, and not by steps, as is necessary in the ordinary metallic-conductor rheostat, and herein lies a considerable advantage where close regulation is required. These rheostats, as built for commercial service, usually consist of a tripod arrangement, between the vertical rods of which are stacked the carbon plates. The adjusting screw is arranged at the top. The plates used are of two sizes in order

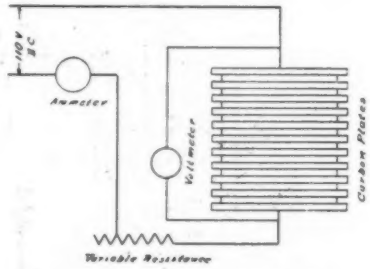


Fig. 2.—Diagram of Connections.

to increase the current-carrying capacity. In making up a rheostat of this kind the plate surfaces should be ground smooth to insure uniform results.

Rheostats of this type, if not overheated, are very durable and fairly cheap to construct. The plates may be secured in any size desired at small expense and a simple framework, with screw attachment, completes the apparatus. If the plates should become broken or damaged in any way it is but a matter of a few minutes to replace them.

In order to illustrate the use of the curves and the results given above, the following design has been worked out:

Given a circuit of a constant resistance of five ohms, with 110 volts impressed. The current is to be controlled by a series rheostat in such a manner that the maximum current obtainable will be 21.5 amperes and the minimum 17 amperes. The maximum drop in volts in the load will be $21.5 \times 5 = 107.5$ and the minimum $17 \times 5 = 85$ volts. The minimum volts drop in the rheostat will therefore be $110 - 107.5 = 2.5$ and the

maximum 110 — 85 = 25 volts. The minimum resistance in the rheostat must therefore be 25/21.5 = 0.116 ohms, and the maximum resistance 25/17 = 1.47 ohms.

From Fig. 3 it will be noted that about seven amperes per square inch represents the average of the current densities tested, so this value will be chosen. A larger current density could be chosen but the temperature rise would be higher.

Assuming the rheostat to be made up of two sizes of plates, the area of the smaller plate must be 21.5/7 = 3.08 square inches. Using a square plate, its linear dimension will be 1.75 inches along each edge. Assume plates to be 0.125 inch thick.

Allowing a minimum pressure of eight pounds per square inch, the resistance per square inch per contact from Fig. 4 will be .023 ohms and the resistance per plate will be 0.023/3 = 0.0073 ohms, which is the maximum value of resistance per plate.

The total maximum resistance of the rheostat must be 1.47 ohms so that the number of plates will be 1.47/0.0073 = 200 and the length of the rheostat will be 200 × 0.125 = 25 inches. Since the minimum resistance must be 0.116/200 = 0.00058 ohms or 0.00174 ohms per square inch, the maximum pressure will be, from Fig. 4, 165 pounds per square inch, so that the frame work of the apparatus must be designed to withstand a total load of 165 × 3 = 495 pounds.

Allowing a temperature rise of 60 degrees centigrade and taking a radiating coefficient of 0.0043 watts per square inch per degree rise, each square inch of radiating surface must radiate 0.258 watt.

The maximum watts to be radiated is 25 × 17 = 425 so that the radiating area must be 1,650 square inches. Since the edges of the 100 smaller plates have a combined area of 7 × 100 × 0.125 = 87.5 square inches, the larger plates must project far enough to offer 1,526.5 square inches.

If a standard three-inch plate be used for the larger size the area of the edge will be 0.125× 3 × 4 × 100 = 150 square inches. The area of the projecting parts will be 9 — 3.08 = 5.92 for each side of each plate, or 1,184 square inches total. The combined area of edges and projecting faces is 1,334 square inches. It will be better to use this standard size of plate and let the temperature rise somewhat higher than 60 degrees, as allowed.

The minimum temperature rise will be 2.5 × 21.5/0.0043 × 1,421 .= 8.8 degrees centigrade.

In closing the writer wishes to express his appreciation of the efforts of Mr. W. H. Baxter, of the Class of 1909, School of Electrical Engineering, Purdue University, who completed the tests herein described as undergraduate thesis.

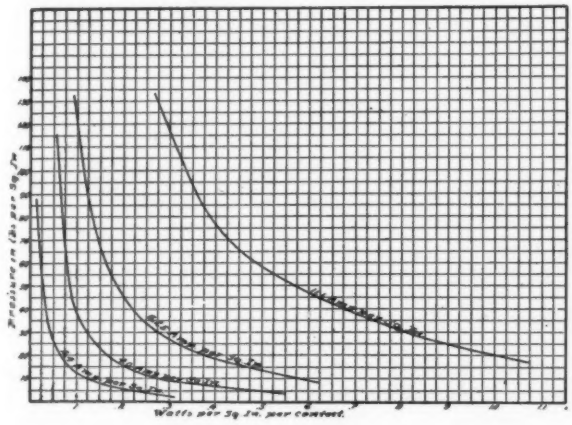


Fig. 3.—Variation of Watts with Pressure.

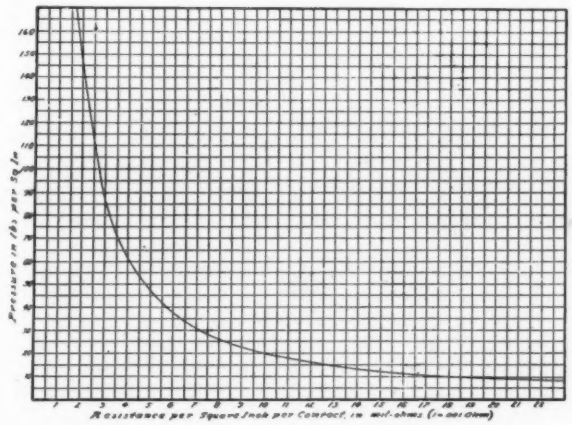


Fig. 4.—Variation of Resistance with Pressure.

Electric Subway for Naples, Italy.

The first city subway in Italy is to be constructed at Naples. The concession has just been granted by the Ministry of Public Works to the Société Francaise-Italienne des Chemin de Fer Metropolitaine de Naples, with an initial capital of $3,088,000. The estimated cost is $5,790,000, to be met entirely by the concessionary company.

The line will be both urban and interurban, the former with a total length of 4.97 miles and the latter 6.21 miles and is to be completed in four years. Similar projects are under consideration both at Genoa and Rome, but thus far the Naples subway is the first in Italy upon which definite action has been finally taken, and its construction has therefore awakened general interest throughout Italy. The construction of the line offers an opportunity to American manufacturers.

To Set Clocks by Wireless.

The regulation of all the public clocks by wireless energy is the progressive and ambitious plan just adopted by the secretary of the imperial Post Office Department in Germany.

According to the project of the inventor, an electrician named Ferdinand Schneider, which has received the support of the military and naval authorities, a central station will be erected near Fulda, centrally situated for the whole empire. It will have a tower 325 feet high, from the top of which the electric waves will be discharged at one-minute intervals, affecting the hands of all the clocks in the system. Three clocks will be employed in the central station, switching in interchangeably to guarantee absolute accuracy.

It is planned to have only one receiving clock in each town, other timepieces in the same place being connected with it on the ordinary electric circuit now in use.

Preparatory steps have already been taken toward erecting the central establishment at Fulda. The inventor guarantees that the system will work with absolute accuracy and that the wave cannot be interfered with by those of other wireless stations. The service, it is thought, owing to the great number of clocks which can be controlled from the one station, will be comparatively inexpensive and the obvious advantage of absolutely uniform time throughout the country has also appealed to the authorities.

Kentucky Legislation.

The House has passed a bill granting to Kentucky cities of the fourth class the right to regulate their own electric companies and water-works. An important provision of the measure allows such cities to expend the earnings of their public utilities in any manner deemed advisable.

New Electrical and Mechanical Appliances

New Multiple-Switch Starter.

An original type of multiple-switch starting rheostat for large direct-current motors has been developed by the Independent Electric Manufacturing Company, of Milwaukee, Wis. The idea in its design was to make it as simple as possible and positively fool-proof in operation.

The individual resistance-short-circuiting switches are of very simple construction, all being pivoted on the upper shaft. Each switch arm carries a roller that bears against a cam on the lower shaft. These cams are so mounted that as the lower shaft is turned the switches are closed one after another in definite sequence. To prevent closing the switches too rapidly a special latched lever, known as the master lever, is provided. A pawl attached to this lever can be made to engage the notches of the middle of three ratchet wheels at the right end of the lower shaft. The master lever has a limited oscillating motion so that its pawl must engage each notch in succession and thus turn the lower shaft and its cams through a definite angle, closing one switch after another. The operator throws the master lever just like an ordinary switch, releases the latch, draws the lever back and throws it in again, at least two seconds being required to manipulate each switch. The shape and diameter of each cam is such that the actual closing of each switch is quick and positive.

The lower shaft turns against the helical spring at its left end. To prevent the opening of the switches before the entire operation is completed, the lower or left-hand lever is provided to engage the ratchet at its left and hold the shaft from turning back when the master lever is withdrawn. Release of either lever before all the switches are closed opens them all automatically, thus preventing overheating of any of the resistances which are designed for starting duty only. An underload release is provided to engage the ratchet at the right end when all the switches have been closed and thus retain them in place until the power is cut off. An overload release coil can also be provided, although not shown on the illustrations herewith. The first switch at the left is provided with carbon-break auxiliary contacts, as it is the first switch closed and the last switch opened in the use of this starter.

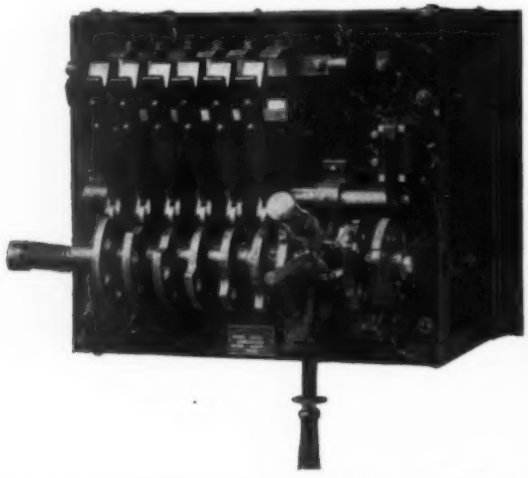


Fig. 1.—Multiple-Switch Starter With Master Control.

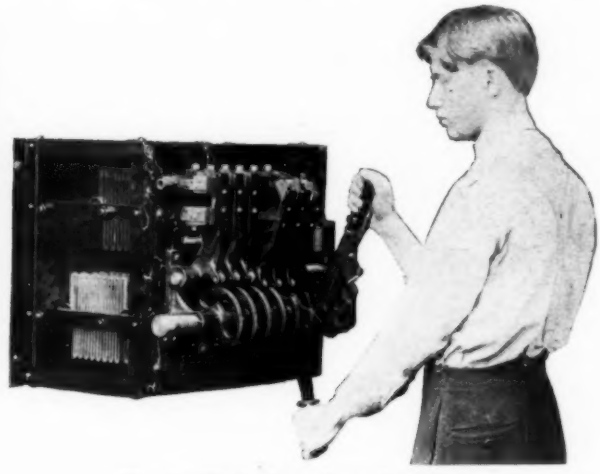


Fig. 2.—Method of Operating Starter.

New Stepless Street Car Being Tested in New York.

A stepless car designed by Frank Hedley, vice-president and general manager of the New York Railways Company, and J. S. Doyle, superintendent of car equipment, was put in operation in New York City recently to give it a practical test.

The new car is constructed with the idea of safety, sanitation and convenience. It is 40 feet 9 inches long as compared with the regular New York street cars, which are 47 feet in length, and seats 51 passengers as against a capacity of 40 people in the present style of cars. It has two side doors 10 inches above the ground, as compared with the 30-inch level of the cars used at present. The doors are opened automatically when the car stops, and before the car can be started must be closed for the completion of the motor circuit. The new car is equipped with pneumatic fenders, which also act automatically in shutting off the circuit from the motor in case a person is struck. Pedestrians are protected from the wheels by a sort of skirt which reaches down within three inches of the rails.

The interior of the car resembles a launch, with large semicircular seats at the rear and with 16 regular double seats. The ventilation and heating of the car are regulated automatically by the number of passengers, whose weight affects the adjustments regulating the air and temperature. The motorman is provided with a completely vestibuled compartment and a comfortable seat.

A Non-Replaceable Fuse Device.

A non-replaceable fuse has been designed by G. E. Painter, 324 North Charles Street, Baltimore, Md., for the purpose of furnishing greater protection against fire, by preventing circuits from being overloaded. The non-replaceable fuse is supplementary to the

usual fuse, and has a greater carrying capacity, so that it comes into play only in case the regular fuse is bridged, or too large a fuse is used.

In general appearance it is similar to the present type of fuse blocks. The only difference is, it is made in two halves, and has an extra fuse placed between them. This fuse is connected in series with the fuse terminals as now in use, and cannot be removed without destroying the block.

The non-replaceable fuse will have a carrying capacity of about 10 per cent more than the fuse block is intended to carry; therefore, it will never blow as long as the block is properly fused with the present type of fuses.

The non-replaceable fuse will be placed in the block by the manufacturer, who will also seal the two parts together in such a manner that they cannot be taken apart to renew the non-replaceable fuse without breaking the block, therefore the block must be replaced by another. The blocks, however, can be sent back to the manufacturer for renewing the non-replaceable fuse, as it will only require a new bottom to replace the other, which has to be broken to get it apart.

The blocks can be made with the same outside dimensions for, say, 10, 20 and 30 amperes, and fitted with the same size fuse terminals, so that any of the present type of fuses (of its class) can be used up to the rated capacity of the non-replaceable fuse. As the blocks are now arranged for fuses up to 30 amperes, it is no easy matter to trace out all the different circuits to see if they are overfused (under the Code), and there is no way to prevent persons from replacing the fuses by larger ones, after the inspection, so as to allow for additional or larger-candlepower lamps.

Fig. 1 shows the device adapted for panel boards. It will be noted, that the receptacle or cutout can be removed, without disturbing the rest of the panel or wiring. The non-removable fuse is shown in the bottom piece of the fuse case. The fuse plug also shows the usual way of bridging this type of fuse.

Fig. 2 shows a two-wire double-branch Edison-plug cutout.

With this new device in use, the inspector will not be required to examine each fuse to see if it has been bridged, or if it is of proper size, for if the block is of proper capacity, it will be a guarantee that the circuit is properly protected, regardless of the removable fuse.

If the inspector desires, he can place a seal or stamp upon each block when making his first inspection. On subsequent inspections he will only have to examine such blocks as have no seal, and the circuit controlled by the same. He can also easily see if a block has been replaced for any cause, or a new circuit added since the last inspection.

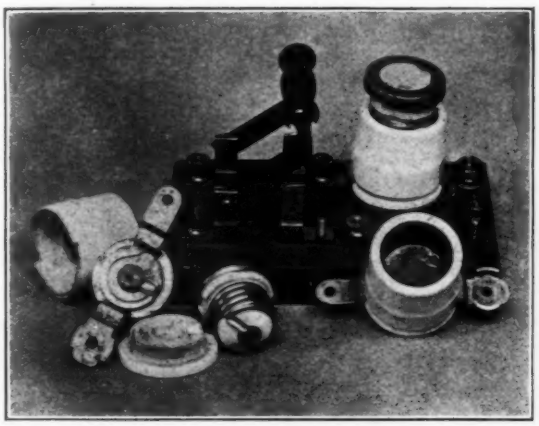


Fig. 1.—Non-Replaceable Fuse as Adapted for Panel Boards.

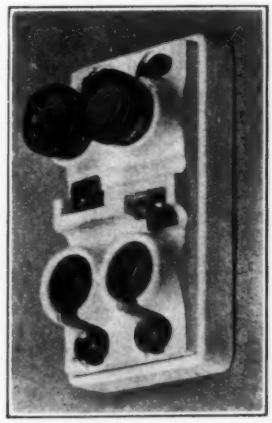


Fig. 2. Non-Replaceable Cutout.

If the device is used, it will force owners or unscrupulous contractors to allow for the required number of circuits and lamps to properly light the building, when the wiring is being installed. For after it has been inspected it will be impossible to overload the circuits with more or larger lamps than is safe, or allowed under the Code, without it being easily detected by the inspector.

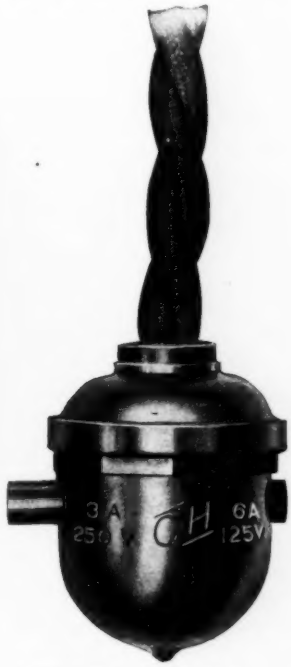
The principle involved in a second fuse which is non-replaceable is similar to that which prompts the placing of two safety valves upon a boiler, one being arranged so that the engineer in charge can set it at any desired pressure, the other being locked by the boiler inspector.

A New Pendent Switch.

The word "dainty" best describes the new brass-shell pendent switch placed on the market by the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis. The shell, fashioned like an acorn is only a trifle over 1.75 inches in height and the weight of a complete switch is less than two ounces.

The attractive appearance of this switch and the remarkable reduction in size and weight has been attained without any sacrifice of serviceability. Removal of the cap (which is held in place by a snap lock) reveals a simple but rugged interior mechanism operated by a straight push-bar, similar to that used in Cutler-Hammer porcelain pendent switches. Ample terminal space is provided for wiring and the Underwriters' label testifies to the fact that the new switch has successfully met the rigid requirements of the Underwriters' Laboratories.

The Acorn switch operates with a quick snap and the whole of the operating mechanism, except the projecting push-buutons, may be concealed under a half-dollar coin. No porcelain is used in the construction of this switch, a new insulating material, developed in the ceramic laboratory of the Cutler-Hammer Manufacturing Company, being used for supporting the operating mechanism. The new material is said to be unbreakable under ordinary service conditions and can be molded with much greater accuracy than porcelain.



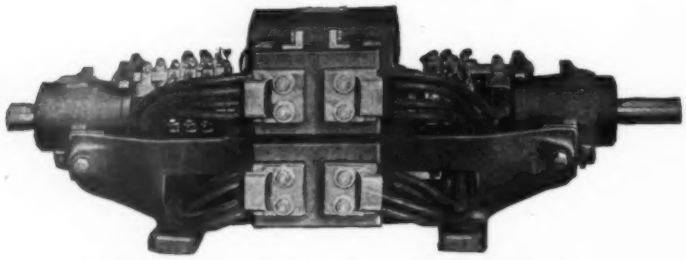
Acorn Pendent Switch.

The brass cap is designed to be snapped onto the shell and is provided with a hard-rubber bushing which accommodates either standard or reinforced flexible cord. In spite of its small size the new switch has the usual ampere capacity for snap switches, being rated at 6 amperes, 125 volts or 3 amperes, 250 volts.

Generators for Electrolytic Work.

The standard types of generators for electrolytic work, as manufactured by the General Electric Company, are four-pole machines built in five sizes from 1.5 to 15 kilowatts. They run at standard speeds so that, if desired, they may be direct-driven by induction motors where alternating current of 60 cycles is available.

Thorough ventilation of the armature insures cool running. Fan blades, fastened to the armature heads, in connection with air ducts leading from the center of the core to the circumference, provide adequate ventilation of all parts. The bar windings, which are insulated carefully and connected at the end by copper ribbons, are inserted in insulated slots so that in case of accident to one or more bars, they can be easily removed without disturbing the remainder of the winding. All connections between the armature winding and the commutator are soldered to insure that there will be no loose connections and consequent sparking at the brushes. The field coils are wound on forms; this permits their easy and quick removal from the poles in case of accident.



Electrolytic Generator With Double Commutator.

Most of these generators are arranged for one voltage only and consequently have but one commutator. They are self-excited generators and will give potentials of from 2 to 6 volts with 250 to 500 amperes, the voltage regulation being accomplished by varying the field. Several of the machines are of the double-commutator design, the armature having two distinct windings, one connected to each commutator. The terminals may be connected so that the two windings will be in series or in multiple, giving a potential equal to the sum of their voltages and a current equal to that generated by one, or a potential equal to that of one winding and a current equal to the sum of the currents from the two windings. Such a machine may also take the place of two generators, each winding serving as a separate machine.

New Oscillator for Wireless.

A system of producing undamped electrical oscillations of extremely high frequency has been devised by E. K. Chaffee, of Harvard University. The oscillations are produced with greater regularity than by any other method at present in use.

A direct-current generator is connected through the primary of a closely coupled oscillation transformer and variable resistance and inductance to the oscillation gap, consisting of two parallel plates 0.07 millimeter apart. The anode is of copper or silver and the cathode of aluminum, each being between one and two square centimeters in area. The electrodes are surrounded by moist hydrogen at atmospheric pressure. The primary of the transformer and the spark gap are shunted by an air condenser and another is placed in series with the secondary of the transformer, both being readily adjustable for resonance.

Large Order for Transmission Towers.

The Riter-Conley Manufacturing Company, Pittsburgh, Pa., has booked an order from Barcelona, Spain, which calls for 1,350 galvanized steel towers for power-transmission wires. The towers are to be set 2,000 feet apart and will be used in one of the most extensive power development systems in Spain.

For the making of the towers there will be required 3,500 tons of structural steel. The cost of the work and material, at the Pittsburgh plant, will be slightly in excess of $250,000.

The line on which the towers will be used, which is now under course of construction, will be 240 miles in length and will reach from a large hydroelectric station to many of the principal cities of Spain. The power to be developed will be used by street car and lighting companies.

The Spencer Air Cleaner for Air Compressors.

The Lord Manufacturing Company, 213 West Fortieth Street, New York City, several months ago purchased the entire business, plant and patents of the Spencer Air Purifying Company. This company was engaged for a long time in developing a practical air cleaner to be applied at the suction port of air compressors. Although designed originally for street-car compressors, these cleaners have been adapted to any form of air compressor of the stationary as well as traction types. They are made for machines having capacities up to 7,000 cubic feet per minute. Some installations are on ventilating plants, indirect heating steam locomotives, and for other varied service.

An interesting test of the value of the Spencer air cleaner was recently terminated. In July, 1910, a number of street cars were equipped with these cleaners, and at the same time another group of cars of the same type and identical equipment throughout, were placed in service without any cleaner connected with their air compressors. All of these cars had been in continuous service under identically the same operating conditions for over eighteen months when an examination of the compressor equipments was made.

Spencer Air Cleaner.

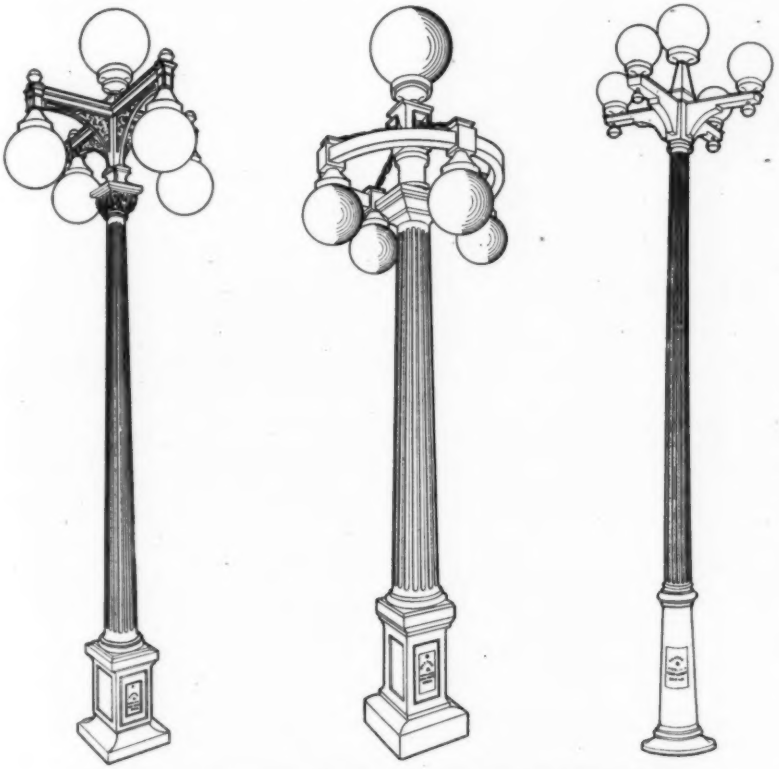
Those of the compressor sets that were not equipped with the cleaning device had their valves badly worn and gummed, the valve seats needed regrinding, the pistons and rings were worn and leaky, and the compressors in general had deteriorated quite considerably. They pounded badly, showing evidences of lost motion in the cranks, gears and other parts.

On the other hand, those compressors that were protected by the Spencer air cleaner showed substantially no wear; they ran smoothly and without any pound whatsoever. A number of the air compressors equipped with the cleaner and without were bled, reducing the air pressure to zero; then each one was started up to determine the time required to compress air to 60 pounds pressure. The compressors that had the Spencer cleaner attachment required on an average one minute, thirty-one seconds, whereas those without this provision required from three minutes, twenty seconds, to nine minutes, two seconds, showing very forcibly the value of the cleaner in keeping the compressors in serviceable condition.

Paxton & Vierling Ornamental Street-Lighting Posts.

The popularity of the tungsten-cluster system for ornamental street lighting has led the Paxton & Vierling Iron Works, of Omaha, Neb., to develop a series of some twenty designs of posts for this purpose. A few typical ones are reproduced herewith.

Fig. 1 design has a height of 12 feet to the top of the cross-arms; the base is 15 inches square; the fluted shaft tapers from 8 to 5 inches. The design is rich, dignified and harmonious throughout. The design in Fig. 2 is unique. The cluster ring is supported by cast-iron imitation chains, thus making it rigid. The total height over the top globe is 13 feet, 8 inches. A taper of 10 to 7.5 inches is found in the fluted shaft. A more slender and simpler design is shown in Fig. 3. Its height to the top of cross-arms is 12 feet. The shaft tapers from 7 to 4 inches. The cluster arms are adjustable.



Figs. 1, 2 and 3—New Designs for Ornamental Cluster Posts.

Most of the designs made by this company can be furnished with two, three or five lights. Special attention has been given to the construction of the cross-arms to give the lowest possible cost in wiring. The top of the cross-arms and upper globe holder is readily removable, giving very easy access to the liberal wire space in the hollow arms. When assembled, however, the cluster arms are entirely watertight. In each base there is a door of convenient size to give free access for wiring and to permit the placing of cutouts or switches. The company also makes single-lamp standards of several designs for park and boulevard lighting, and combination poles for trolley and cluster-lighting service.

The Increasing Use of the Telephone for Train Dispatching.

The introduction of the telephone in the field of train dispatching still goes on with rapid strides. Its success has been emphatic and very gratifying to the officials on whose roads it has been installed. Of the railroads in the United States, which have adopted the telephone for handling trains, about 90 per cent are using the apparatus manufactured for that purpose by the Western Electric Company.

The New York Central & Hudson River Railroad quite recently placed an order for 45 telephone sets and miscellaneous supplies, to be used in extending its system. Still more recently it placed a further order for 70 similar telephone sets, 54 transmitter arms, 30 portable telephone sets with the same number of line poles, 60 test panels and a considerable quantity of miscellaneous supplies.

In the West, the Davenport & Muscatine Railway, operating between Davenport and Muscatine, Ia., a distance of about 25 miles, is installing selector and telephone way-station equipment. In the South another railway system to adopt the telephone is the Gulf, Florida & Alabama Railway, of Pensacola, Fla., which has given an order for the equipment of 100 miles of line. The apparatus to be furnished consists of 20 selectors, 15 siding sets, 12 portable sets and the necessary line material.

Other railroads in the East and South, so it is reported, are constantly sending in repeat orders. The Lehigh Valley will install a special yard dispatching circuit consisting of eight complete selector stations; it has also ordered 140 portable telephone sets with line poles. A total of 55 wall telephones and miscellaneous material for train dispatching circuits is going to the Norfolk & Southern Railroad Company, while the Norfolk & Western has ordered 90 Adjustaphones (transmitter arms), with the necessary generator sets and miscellaneous pole-line hardware for two dispatching circuits.

The Chesapeake & Ohio is steadily extending its telephone lines and has recently installed 46 additional desk-type telephone sets with miscellaneous line material. For use on the line between Columbus, Ga., and Birmingham, Ala., the Central of Georgia has ordered 30 portable sets and line poles. The Baltimore & Ohio will shortly install 35 additional way-station sets.

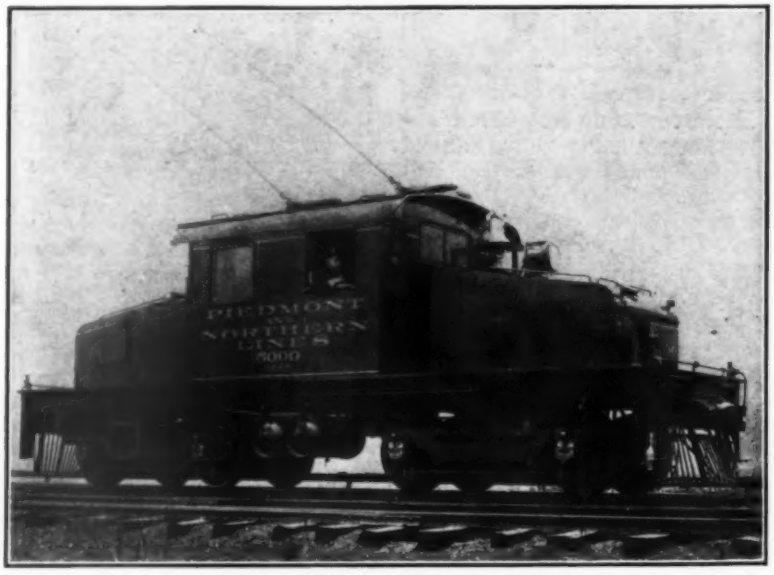
Designing Oil-Engine Pistons.

In a recent discussion regarding oil-engine pistons Wolcott Remington, the designer of the Blanchard oil engine, stated that in such an engine the length of the piston should not be less than 1.5 times the bore, as this gives ample bearing surface. Mr. Remington advises using light piston heads thoroughly ribbed on the under side, because this does away with the excessive pressure from the piston and at the same time gives ample strength. The ribs also radiate the heat from the piston head and so prevent its becoming overheated to the extent it would if there were no ribs. In the case of a 10-by-10-inch engine of the two-cycle Blanchard type, the length of the piston would be 15 inches with thickness at the top 1.5 inches and at the side 0.375 inch.

Five of the largest office buildings in New York City have as many telephones as ordinarily serve a city of 100,000 inhabitants.

Highest Voltage Direct-Current Locomotive in the United States.

Recently the East Pittsburgh works of the Westinghouse Electric & Manufacturing Company completed equipping an electric locomotive for the Piedmont Traction Company, which will operate an extensive electric railway system in the Piedmont section in North Carolina and South Carolina. This locomotive is one of six to operate at a direct-current pressure of 1,500 volts. This is the highest direct-current voltage as yet used by any electric railway in the United States.



1,500-Volt Direct-Current Locomotive.

The mechanical parts of the locomotives were built by the Baldwin Locomotive Works, Philadelphia, Pa. Steel construction is used throughout. The locomotives weigh 55 tons each and are equipped with four 750-volt, 180-horsepower Westinghouse motors. Each locomotive is able to haul 40 freight cars weighing 45 tons each with load, at 20.5 miles per hour on a straight level track, or 9 cars at the same speed on a one-per-cent grade. The motor equipment is controlled by the Westinghouse electro-pneumatic, unit-switch type of control. Electric power for operating the Piedmont properties will be supplied by the Southern Power Company.

Field Electric Omnibus for Depot Service.

What is believed to be the first successful electric omnibus line using storage batteries and running on a definite schedule, has been in service during the past winter in Chicago. Four of these omnibuses have been employed in making regular trips between the large department store of Carson, Pirie, Scott & Company, and the new Chicago & Northwestern Railway terminal station. They have run chiefly along the busiest part of Madison Street, covering a distance of a little over half a mile, in which is a heavy grade at the bridge crossing the Chicago River. Although the winter was the most severe known in Chicago for the past forty years, these buses kept strictly to their schedule, not losing a single trip and carrying a very large number of passengers.

Field Electric Omnibus.

The frequent blizzards of the last few months hampered the street railways and other transportation lines very materially, but the Field electric buses plowed through in some cases as much as three feet of snow without any difficulty.

These buses were designed by C. J. Field, vice-president of the Electric Omnibus Corporation, 39 Cortlandt Street, New York City. This company also builds a number of larger types of buses carrying from 30 to 34 passengers. In all of these buses Edison storage batteries are employed. A 60-volt motor is mounted in the middle of the chassis. Its shaft is geared to a countershaft that is connected by chains to the rear wheels. In the Carson, Pirie, Scott & Company buses the entrance is from the front only, the passengers entering and alighting at the side of the operator who also observes them as they deposit the fare in the cash box at his side. The control system is very simple and provides for six speeds forward and three back. The control lever is mounted on the steering-wheel column. Two independent sets of brakes are provided. The motor and gear equipment provides for a maximum speed of twelve miles per hour, which has been found abundant in the congested district through which these buses run. The batteries receive only one regular charge per day, which enables them to make a total run of as much as 80 miles. During waiting intervals at the store the batteries are given occasional boosting charges.

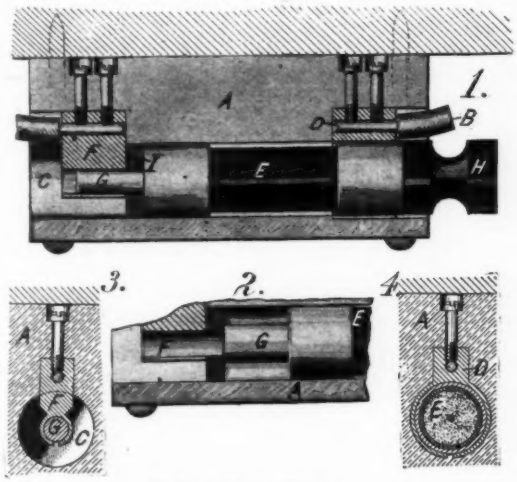
Another 1,200-Volt Railway.

The 25 electric cars of the Kansas City, Clay County & St. Joseph Railway Company, Kansas City, Mo., will each be equipped with four 100-horsepower motors, type M motor control, and variable-release automatic air-brake equipments recently ordered from the General Electric Company, Schenectady, N. Y. This road is to be operated on the 1,200-volt direct-current system, but the intention is to provide eventually for increasing the voltage to 1,500. The equipment is designed to accommodate this voltage.

A Safeguarded Fuse Block.

A. A. Moffitt and G. E. Andrews, of 40 Bridgham street, Providence, R. I., have invented a fuse block that prevents overfusing a circuit above its safe carrying capacity. It has been found that fuses which blow often are frequently replaced by fuses that permit a dangerous overload on a circuit. In the design described herewith this is positively guarded against, because each fuse block is made for only one definite size of fuse and that combination of fuse and fuse block must be used which is appropriate for the safe maximum carrying capacity of the circuit.

As shown in Fig. 1, the block *A*, usually of porcelain, is provided with terminals for the wires which are held securely by screws. The block has a cylindrical pocket *C* into which the fuse is inserted. In this pocket is an annular insulating partition *I* fitting close up to the enlarged terminal *F*. Fig. 3 shows a sectional view of this terminal which carries a pair of clips integral with it. The opening in these clips registers with that in the partition *I* and is just large enough to receive an extension or plug terminal *G* of the fuse *E*. Fig. 2 shows why a fuse that is too large cannot be used, since each fuse has a plug *G* of definite size corresponding with its capacity. At the other end of the fuse the terminal *D* engages the cylindrical shell of the fuse and a handle *H* is provided to facilitate insertion and removal of the fuse.



Safety Fuse Block.

Annual Sales Convention of Fort Wayne Electric Works.

Fifty odd members of the sales and engineering organization of the Fort Wayne Electric Works attended the annual sales convention of the Fort Wayne Electric Works, at Fort Wayne, Ind., during the week ending March 30.

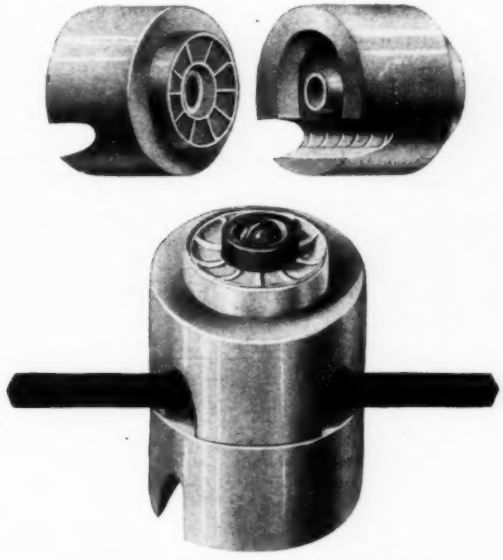
Sessions were held morning and afternoon of each day, when reports were presented and the engineering department described and explained the development of the company's apparatus. The annual banquet was held on Thursday evening, and Friday was devoted to an inspection of the shops and engineering department.

Transformers for 150,000-Volt Power System.

Transformers for a 150,000-volt transmission line are now under construction by the Allis-Chalmers Company, of Milwaukee, Wis. They are rated at 4,000 kilovolt-amperes and are of the single-phase, 60-cycle, oil-insulated, water-cooled type. These transformers are for service on the lines of the Nevada-California Power Company. The transformers are designed for 6,600 volts on the low-voltage side and 87,000 volts on the high-voltage side. Three transformers will form a group, which will be connected in delta on the low-voltage side. The high-voltage side is to be star connected to give a line tension of 150,000 volts. The transformers are designed for an insulation test between high-voltage and low-voltage coils or between high-voltage coils and iron of 300,000 volts for one minute. The principal dimensions are as follows: diameter of base, 8 feet 10 inches; height to top of cover, 15 feet 8 inches; height to top of high-tension terminals, 19 feet 10 inches. With normal supply of cooling water these transformers will carry full rated load for 24 hours with a temperature rise not exceeding 40 degrees centigrade. They will carry 25 per cent overload continuously with a temperature rise not exceeding 55 degrees centigrade. Each transformer complete with oil will weigh about 43 tons, and the efficiency at full load will, it is claimed, be considerably over 98 per cent.

The Findlay Interchangeable Self-Centering Split Knob.

The Findlay Electric Porcelain Company, Findlay, O., has placed on the market an interchangeable porcelain knob, a good idea of the application of which may be had from the accompanying illustrations. One part is exactly like the next, therefore each part is interchangeable. There is no fussing about with caps and matching up, and consequently there is an absolute elimination of waste material. These knobs are self-centering, and the pieces may be used for straight wiring jobs or crossovers. The grooves are deep, firmly holding the wire, and they will not break even when installed with wire nails.



Findlay Self-Centering Split Knob.

Alternators to Generate 30,000 Volts.

Ganz & Company, of Buda Pesth, Hungary, are building another three-phase alternator to generate 45-cycle current at 30,000 volts. The machine is rated at 5,200 kilovolt-amperes, is 13 feet in diameter and runs at 225 revolutions per minute. It is for the generating station of the Società Anglo-Roma at Rome, where it will run in parallel with two other machines which have been operating at this pressure for over five years with perfect success. This generator voltage eliminates step-up transformers in this case.

Ultra-Violet Light Water Sterilization on a Large Scale.

Ultra-violet light has been employed to sterilize water on a large scale in France, in a plant required to deliver 261.5 cubic yards of water per twenty-four hours. The apparatus utilizes the copious emission of these short waves from a mercury-vapor lamp having a quartz tube. More than three-quarters of the rays coming from the special lamp are utilized, and sterilization to the point of leaving one germ to the cubic centimeter is accomplished by causing the water to traverse a zigzag path close to the lamp, thereby exposing it to the repeated action of the waves.

The test showed that the process was highly efficient for municipal purposes. It is low in cost and simple in operation, occupies little space, uses a very small amount of electric current, and imparts no taste to the water, which remains fresh, since it retains its dissolved air and has not been heated in any way. For municipal water service the apparatus may be applied to the outside of the ordinary main, the radiations being transmitted through quartz windows in the main.—*Scientific American.*

A New Electric Bicycle Lamp.

A new electric bicycle lamp has been introduced in Amsterdam, Holland, for which electricity is generated by the operation of the bicycle. A small wheel attached to the shaft of the dynamo rests on the front or rear wheel of the bicycle, making many revolutions for each one made by the larger wheel. When the lamp is not needed, the little wheel can be set free from the bicycle wheel by a lever. A very powerful light is obtained at a speed of 10 miles an hour, but sufficient light is obtained at even greatly reduced speeds.

Panama Canal Motor Contract Awarded.

The General Electric Company has been awarded the contract for motors for operating the locks and valves of the Panama Canal. The contract price is $150,000.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

CONDUIT OUTLET PLATES.—Sprague Electric Works of the General Electric Company, 527 West Thirty-fourth Street, New York, N. Y.

Catalog No. 6425 for use with half-inch rigid conduit.

Approved March 4, 1912.

SWITCHES, COMBINATION CUTOUT.—Metropolitan Engineering Company, 1250 Atlantic Avenue, Brooklyn, N. Y.

"M. E. Co." Combination Sealable Service Switches and Cutouts; 250 volts, 0-30, 31-60 and 61-100 amperes.

Catalog Nos. 701-703 inclusive, three fuses, and special handle whereby all may be withdrawn simultaneously when the device is used as a switch.

With or without terminal protectors, Catalog Nos. 9020-9030 inclusive, and 9070-9072 inclusive.

Note: These devices are not considered suitable for use in connection with secondaries not properly grounded, since they are not so designed that they can be promptly opened by a single operation.

Approved February 12, 1912.

SWITCHES, OIL-BREAK.—Hartman Circuit-Breaker Company, Mansfield, Ohio.

Standards for the construction and test of oil switches of both the manually-operated or non-automatic type and the automatically operated or circuit-breaker type are under consideration.

Pending the establishment of such standards, the results of examination of construction details and reports of satisfactory performance in the field indicate that the 600-volt alternating-current oil switches and circuit-breakers made by this manufacturer are suitable for use.

This company is also prepared to furnish for circuits of higher voltages oil switches and circuit breakers which it guarantees to be suitable for use at the assigned ratings of current and voltage. Inspection departments having jurisdiction should in all cases be consulted before such switches or breakers are installed.

Approved March 1, 1912.

Transformer for Bell Circuit.

SWITCHES, PUSH-BUTTON-FLUSH.—Metropolitan Electric Manufacturing Company, East Avenue and Fourteenth Street, Long Island City, New York, N. Y.

This company is equipped to supply push-button flush switches with standard labels.

Push-button flush switches shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters, and examined and tested at factories under the supervision of Underwriters' Laboratories, have labels attached to each device.

Approved February 27, 1912.

TRANSFORMERS.—Empire Electric Company, 2846-2856 Evanston Avenue, Chicago, Ill.

Bell-ringing transformer for use on lighting circuits. Primary 110 volts, secondary 6 volts. To be used for ringing bells, or for similar signaling work when primary wiring is installed in accordance with Class C of the National Electrical Code.

Approved March 4, 1911.

WIRES, RUBBER-COVERED.—Diamond Rubber Company, Akron, Ohio.

Marking: One red and one black thread parallel in braid with one red thread crossing. National Electrical Code, 1911 Edition.

Approved Otcober 16, 1911.

WIRES, RUBBER-COVERED.—National India Rubber Company, Bristol, R. I.

Marking: Two blue threads parallel with wire between insulation and braid.

National Electrical Code, 1911 Edition.

Approved February 28, 1912.

WIRES, RUBBER-COVERED.—Detroit Insulating Wire Company, Wesson Avenue and Albert Street, Detroit, Mich.

Marking: Three uncolored cotton threads parallel with conductor between the insulation and the braid.

Approved February 3, 1912. National Electrical Code, 1911 Edition.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

HATTAN, N. D.—It has been voted to build an electric light plant. C.

GEORGE, IOWA.—Harry Hatch will build an electric light plant here, it is reported. C.

MENLO, IOWA.—An electric light franchise has been granted to C. Buckley & Company.

VERNDALE, MINN. — Verndale has voted in favor of installing electric lights.

ROYALTON, MINN. — Work on the Pike Rapids power station will begin this summer. C.

FOLEY, MINN.—A franchise has been granted to Herman Beacker for an electric light plant. C.

GARRETSON, S. D.—Emil Benson is promoting the building of an electric light plant here. C.

TWO RIVERS, WIS.—The council has appropriated $15,000 to enlarge the water and light plant. C.

IDABEL, OKLA.—The Idabel Light & Fuel Company has been granted a 20-year electric light franchise.

CLARINDA, IOWA.—The Lee Electric Company has been incorporated with a capital stock of $400,000.

CENTRAL CITY, IOWA.—F. S. Cross has been granted a franchise to furnish electric light and power. C.

EARLIMART, CAL. — The Tulare County Power Company will extend its lines into the Earlimart district.

BINFORD, N. D.—The Commercial club is considering the advisability of securing an electric lighting plant for this city. C.

CORSIA, S. D.—It is reported that local capitalists have purchased a site and are preparing to install an electric light plant.

GARRETSON, S. D.—Emil Benson has been granted a franchise for an electric light plant. Work will begin soon. C.

NACOGDOCHES, TEX.—A bond election here in the sum of $65,000 for an electric light plant, etc., has been carried.

EAGLE LAKE, TEX.—The Eagle Lake Water & Light Company has been incorporated by George Herder and others.

AUGUSTA, ME.—The Truckee River General Electric Company has filed articles of incorporation with a capital stock of $3,000,000.

WILBURTON, OKLA.—The Wilburton-McConnell Light & Power Company has been incorporated with a capital stock of $12,000.

FOREST CITY, IOWA.—A new electric light plant is to be erected in Forest City. Frank Kellogg is president of the company.

PORTSMOUTH, IOWA. — Peter Herkenrath and G. S. Bendon have bought the electric light plant from M J. Coughlin and will remodel it. C.

CROCKETT, TEX.—The Crockett Ice, Electric Light & Power Company has increased its capital stock from $10,000 to $20,000 and will make improvements to the plant. D.

LESTERSHIRE, N. Y.—Endicott, Johnson & Company will shortly commence work on a gigantic power plant to be equipped with four turbine engines.

BISHOP, CAL.—The Bishop Light & Power Company plans to build a new pole line from Bishop Creek to Big Pine to transmit current for lighting that town.

WORTHINGTON, MINN. — The council contemplates installing another unit for the electric light plant and making other improvements to permit having a day current. C.

GREENEVILLE, TENN.—Roy L. Park is reported to be making plans for the construction of a water power plant on the Nolachucky River, near here. He represents outside interests.

WORCESTER, MASS.—The County Commissioners have decided to light the Summer Street jail by electricity and work will soon be begun on the change, which will cost about $2,500.

SAN JOSE, CAL.—The Senorac Power Company has been incorporated with $500,000 capital stock. The directors are C. P. Anderson, J. F. Tatham, D. M. Burnett and A. L. Brassy.

CHATTANOOGA, TENN. — The Merchants' Association is planning a system of ornamental illumination for the business district, including Market and Main Streets. A. W. Burke is president.

CHICOPEE, MASS.—It is stated that the New England Power Company and the Connecticut River Power Company will extend their high-tension power lines to Springfield, Chicopee, Providence and Lowell.

ROCKFORD, ILL.—Joselyn Chandler Electric Lighting Company has been incorporated with a capital stock of $20,000 to operate an electric light plant. The incorporators are J. S. Joselyn, F. H. Chandler and E. D. Chandler.

COOKEVILLE, TENN.—The Anderson & Subb Power Company, of Sparta, is rapidly obtaining rights of way to build an electric power line from its plant in Sparta to this place and Monterey. Work will commence with settled weather.

ENFIELD, MASS.—Engineers for the Ludlow Manufacturing associates have been surveying the west branch of the Swift River at this place, and it is stated that the Ludlow interests are preparing to build a dam and develop electricity on the stream.

MINNEAPOLIS, MINN.—The Liberty Laundry Company is planning the erection of a power plant which will generate heat and electric light. Work will commence in August, according to a statement made by H. J. Tremain, president of the company.

LORDSBURG, N. M.—D. A. Layne and W. D. Murray, of Silver City, will install an electric light and power plant and an ice factory here. Transmission lines will be run from the electric plant to the Shakespere mining district. Robert E. Cameron is manager of the new project. D.

SAN FRANCISCO, CAL. — The Coast Valleys Gas & Electric Company, having a capital of $5,000,000, and the Coast Counties Gas & Electric Company, having a capital of $4,000,000, have filed articles of incorporation and intend to do a gas and electric business in San Francisco and the Coast counties.

OAKLAND, CAL.—The National Power Company has filed articles of incorporation with a capital stock of $10,000,000, with principal offices in this city. The company will deal in electric power developed in mountain streams back of Oroville. Some of the stockholders are Leon A. Gove, H. L. Breed, Charles Gross, J. E. Bowes and E. A. Herman.

McVILLE, N. D.—McVille Electric Light & Power Company has been incorporated with a capital stock of $4,000 for the purpose of purchasing an electric light and power plant, to install, maintain and operate the same, and to buy and sell electric appliances and supplies. The directors are E. C. Olsgard, C. H. Simpson, E. P. Nyhus, all of McVille.

SAN FRANCISCO, CAL. — The Universal Electric Gas Company, which was incorporated last month with Claus A. and Rudolph Spreckels as leading factors, has purchased a lot on the corner of Brannan and First Streets, where it is announced the company will erect a plant large enough to furnish illumination to this city and other cities about the Bay.

SOMERSET, KY.—The Insull interests of Chicago have taken control of the public utilities of Somerset through the purchase of a majority of stock in the United Water, Light & Traction Company, which operates the lighting, street railway and water systems. The water plant will be improved at once, and later the street railway and lighting plants will be improved. The new officers elected are Martin J. Insull, general manager of the United Gas & Electric Company, New Albany, Ind., president; O. H. Waddle, Somerset, vice-president; Robert G. Gordon, Louisville, secretary; George G. Waddle, Somerset, treasurer, and James L. Waddle, Somerset, general manager. The Waddle interests bought the water plant at a receiver's sale about a year ago.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

PRINCETON, MINN.—The Princeton-Bogus Brook Telephone Company has been organized.

BUTTE, MONT.—The Postal Telegraph Company will construct a telephone line to Spokane. C.

COKATO, MINN.—The Knapp Telephone Company is about to begin the construction of a new line.

REGINA, SASK.—Over a thousand miles of telephone lines will be constructed this summer, covering 15 new circuits. C.

PLEASANTDALE, NEB. — The Ringgold Mutual Telephone Company has been incorporated with a capital stock of $1,200.

ULEN, MINN.—The South Branch Farmers Telephone Company has been organized. B. O. Brasset is president and Ole Nyhus, secretary. C.

MOOREHEAD, IOWA.—Oak Ridge Telephone Company has been incorporated with a capital stock of $552 by J. T. Mann, L. Hadler and Nels Carlson.

CAZENOVIA, WIS. — Cazenovia Telephone Company has been incorporated with a capital stock of $1,000 by A. Rego, P. Milfred, John Keller and J. Murray.

CAMERON, WIS.—Cameron Farmers' Telephone Company has been incorporated with a capital stock of $5,700. The incorporators are Charles Lindquist and others.

RULEVILLE, TENN.—Burl Bayou Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are J. W. Riddell, T. H. Brown and others.

DE SOTO, MO.—Jefferson County Telephone Company has been incorporated with a capital stock of $3,000. The incorporators are James A. Bage, James F. Steel and others.

SHEBOYGAN, WIS.—The Wilson Telephone Company has been incorporated. Peter Kuemmet is president; Frank Freihammer, secretary. Construction work will begin in a very short time. C.

NAPOLEON, O.—Napoleon Telephone Company has been incorporated with a capital stock of $50,000 by W. L. Parmenter, Wallace Landis, B. B. Applar, M. Brenneman and John L. Cable.

CHINOOK, MONT.—North Fork Telephone Company has been incorporated with a capital stock of $5,000. The incorporators are Peter Denny, Ben Ripley and R. F. Hansen, all of Chinook.

MEDFORD, ORE. — The Federal Telegraph Company has purchased an 11-acre tract of land one-half mile east of the water tank in Central Point and will establish a large wireless telegraph station there.

EUREKA, CAL.—The Northwestern Pacific Railway Company plans to build a copper-wire telephone system for train dispatching on the Northern Division, the line to extend from Eureka to Shively.

BAD AXE, MICH.—The Consolidated Telephone Company here will greatly extend its telephone system this summer. It proposes to thoroughly develop the territory north of Bad Axe as far as Port Austin.

THAYER, IOWA. — The Eastern Union County Telephone Company of Thayer has been incorporated with an authorized capital stock of $650. The incorporators include A. R. Stoner, N. Earley and Daniel Swindler.

ROSEFIELD, S. D.—The Rosefield Telephone Company has filed articles of incorporation with a capital stock of $15,000. The incorporators are Ben C. Graber, Jacob E. Graber and Jonathan P. Graber, all of Marion, S. D.

TERRY, MONT.—The farmers and stockmen of the Broadview Bench, south of Terry, are forming a stock company for the purpose of building a telephone line from Terry across the Bench, and possibly to the Kempton Bench.

LYERLY, GA.—R. E. Echols, W. D. Gilkerson, J. T. Weaver and R. H. Alexander are the incorporators of a new telephone company which will be known as the Farmers' System. The principal offices of the company will be located at this place.

GASSAWAY, W. VA. — Gassaway Telephone Company has been incorporated with a capital stock of $10,000. The incorporators are David Frame, C. W. Marple, Gassaway; May M. France, Sutton; J. J. Stainaker, Progress; C. N. Snodgrass, Rosedale.

MIDDLETOWN, DEL.—The Diamond State Telephone Company has announced an appropriation of $4,400 for additional aerial cable at Middletown and an appropriation of $1,300 to replace the present submarine cable between Port Penn and Ready Island.

ASTORIA, ORE.—Articles of incorporation of the Mutual Telephone Company have been filed with $2,500 capital stock. The directors of the company are W. D. Torrey, A. J. Gragg and I. N. Fleischner. A line will be built from Seaside to Elk Creek.

STEDMAN, N. Y.—Stedman Telephone Company has been incorporated with a capital stock of $2,000 to operate a telephone line between Stedman and other points in Chautauqua County. The incorporators are Myron Whitney, Sherman; William D. Halladay, Chautauqua; and Walter R. Pettitt, Ashville.

SAN BERNARDINO, CAL.—Articles of incorporation have been filed by the Ontario & Upland Telephone Company, with $100,000 capital stock. The company plans to put in systems and connecting lines in Ontario, Upland and other cities in California. The directors are R. B. Campbell, W. A. Freemire, R. Grant White, H. M. Robinson, and J. R. Pollock.

ELECTRIC RAILWAYS.

(Special Correspondence.)

BOZEMAN, MONT.—The Bozeman street railway will be extended and improved. C.

DULUTH, MINN. — Improvements to the amount of $200,000 will be expended on the street railway system this summer. C.

SAN JOSE, CAL.—Bids will be received until April 22 for the sale of a franchise for a single-track standard-gauge electric railroad in Alum Rock Park.

MURFREESBORO, TENN.—The Murfreesboro Railway Company has under consideration an electric line to be built between Woodbury and Murfreesboro.

CECILIA, KY. — Alfred Taylor, Custer, is interested in the construction of a traction line from Cecelia to Cloverport. It is the intention to extend later to Elizabethtown.

WILMINGTON, N. C.—It is reported that the Southern Realty Company will build an electric street railway from Wilmington to Carolina Beach, a distance of about 14 miles.

EVERETT, WASH.—W. R. Ammon, owner of the Edmonds electric light plant, and Edmonds Richmond Beach are interested in a proposed electric railway to run between Seattle and Everett, *via* Edmonds.

HARLOWTON, MONT.—The Chicago, Milwaukee & Puget Sound Railway Company is making final preparations to electrify its road from Harlowton to Deer Lodge, a distance of 125 miles.

SALT LAKE CITY, UTAH.—Salt Lake & Los Angeles Railroad Company has been granted a franchise to operate a gasoline-motor or an electric interurban line from Saltair into the business district of Salt Lake City.

DOWAGIAC, MICH.—Plans for a branch line which will connect Niles with Dowagiac, through Eau Claire, are being made by E. D. Emmons, general manager of the Chicago, South Bend and Northern Indiana Railway Company.

CLEVELAND, O.—The Chardon, Jefferson & Meadville Interurban Railway Company has been incorporated with a capital stock of $10,000. The incorporators are A. H. Bacon, Henry Orth, L. B. Stanley, C. H. Felton and A. E. DeMayo.

BATON ROUGE, LA.—The Suburban Electric Company has been organized here by S. J. Gianeloni and other prominent business men with a capital stock of $250,000, for the purpose of taking over a franchise for a street railway to the suburbs of the city.

CLINTON, IND.—John A. Johnson, president of the Southwestern Traction Company, announces that his company proposes to build a trolley line between Clinton and Dana, and on to Ridgefarm, Ill., there to connect with the Illinois Traction System.

WESTCHESTER, PA.—The Westtown Electric Company has filed articles of incorporation with a capital stock of $5,000. It is reported that this company will build a line from Media to West Chester. Edward E. Mandeville, Devon, is interested in the project.

WESTERNPORT, MD.—The Keyser Electric Railway Company has been incorporated with a capital stock of $75,000 for the purpose of building an electric road between Westernport, Md., and Keyser, W. Va., a distance of about 10 miles. The incorporators are: Andrew Ramsay, Hazelhurst Sprigg, J. T. Gaffney, F. C. Reynolds and George C. Dixon.

TRENTON, N. J.—The Havana Electric Railway & Power Company has been incorporated with a capital stock of $30,000,000. The company is authorized to construct, acquire and operate an electric railway, light and power plant both in the West Indies Islands and in the United States. The incorporators are Henry A. Bingham and Cornelius A. Cole, of Jersey City, and Henry T. Letts.

SACRAMENTO, CAL.—Articles of incorporation have been filed by the Sacramento Interurban Railway Company, which proposes to construct an electric line connecting Sacramento, Fair Oaks, Orangevale and Roseville. The capital stock is $50,000. The directors are D. W. Johnston, M. N. Williamson, Marshal Diggs, Ray C. Waring, A. D. Kidahl, Charles E. Hollister and James F. Elliott.

OKLAHOMA CITY, OKLA.—C. T. Edwards, promoter of the Oklahoma City-Shawnee interurban lines, has returned from Philadelphia with the news that satisfactory arrangements have been made to finance the road. He announces that the first car will be run between the two cities about January 1, 1913. The line will go through Dale, McLoud and Harrah, practically paralleling the Rock Island.

CHERRYVALE, KANS.—A Board of Appraisers consisting of Asa Smith and George K. Ratliff, Parsons; and Fred W. Johnson, of Dennis, has been appointed to appraise and assess the damage to the property owners along the proposed right of way of the Siggins extension of the Cherryvale interurban, which the Kansas Traction Company is preparing to build. It is said that work will be started at an early date.

INDIANAPOLIS, IND.—Articles of incorporation have been filed by the Indianapolis & Louisville Electric Railway Company with a capital stock of $1,200,000. This is the company which recently purchased the Louisville Traction Company. The new corporation will greatly improve the service between Louisville, Ky., and Indianapolis. Manager Greeley has announced that the company expects within a year to commence work on the new line between Scottsburg and Madison, a distance of 26 miles.

OAKLAND, CAL.—At the organization meeting of the San Francisco-Oakland Railway the following officers were elected: E. A. Heron, president; W. R. Alberger, first vice-president; Dennis Searles, second vice-president. An intimation of what the men behind this combination expect to do in the next few years was given by the filing of a deed of trust for the terminal properties with the Mechanics' Trust Company, of New Jersey, preparatory to a bond issue of $30,000,000. The San Francisco-Oakland Terminal Railways will carry on the improvements planned by the various corporations before the merger. This includes the extension of the Key Route lines to San Jose, to Richmond and up into Central California. The suburban service of the Oakland Traction Company is to be much improved, while a number of new lines are planned for the near future.

NEW INCORPORATIONS.

KANSAS CITY, MO.—Electric Store Company has been incorporated with a capital stock of $6,000. The incorporators are Luther E. Reid, Edward L. Platt and B. C. Thayer.

DAYTON, O.—The W. L. Cotton Company has been incorporated with a capital stock of $5,000 for the purpose of installing electric heat, light and power equipment. The incorporators are W. L. Cotton, V. M. Lesher, M. E. Powell, F. E. Durnell and E. G. Denlinger.

CHICAGO, ILL.—Engstrom Electrical Manufacturing Company has been incorporated with a capital stock of $10,000 to manufacture electrical and mechanical goods.

SOUTH BEND, IND.—The St. Joe Valley Traffic Association has been incorporated for the purpose of filing and prosecuting claims against interurban railroads growing out of transportation.

MILWAUKEE, WIS.—The Electric Construction Company has been incorporated with a capital stock of $10,000. The incorporators are Conrad F. Boos, William Tellier and Louis G. Boisclair.

FLORESVILLE, TEX.—The Floresville Ice & Power Company has been organized here with a capital stock of $1,650,000. The incorporators are W. G. E. Rolaff, Richard Wolfsky and Yale Hicks. D.

ONEIDA, N. Y.—Sylvan Beach Electric Light & Power Company has been incorporated with a capital stock of $10,000. The incorporators are Ira L. Swell, Roswell D. Dowing and Anthony F. Garvin, all of Oneida.

NEW YORK, N. Y.—Little Giant Electric Corporation has been incorporated with a capital stock of $100,000. The incorporators are Charles Swanson, N. Y.; Louis T. Noonan and Arthur D. F. Randolph, New York City.

PEN ARGYLE, PA.—The Slate Belt Electric Light, Heat & Power Company, and the Gap Electric Light, Heat & Power Company, each with a capital stock of $5,000, have been granted charters by the State Department.

NEW YORK, N. Y.—New York Lighting Fixture Manufacturing Company has been incorporated with a capital stock of $10,000. The incorporators are Frank Butensky, Louis Pivarnick, and Sigmund Feuchtwanger, all of New York City.

TOMAHAWK, WIS.—The Tomahawk Light, Telephone & Improvement Company which has been incorporated with a capital stock of $50,000, has purchased the interests of the Electric Water & Telephone Company, and the Tomahawk River Improvement Company.

INDIANAPOLIS, IND.—The Westerfield Engine Electric Starter Company has been incorporated to engage in the manufacture and sale of engine electric starters. The capital stock is $25,000 and the incorporators are G. G. Westerfield, Charles F. Hurst and John E. Spaan. S.

NEW YORK, N. Y.—Phillips Manufacturing Company of New York has been incorporated with a capital stock of $15,000 to manufacture electrical and other supplies. The incorporators are William A. Thompson and Thomas E. Chappell, New York; and William G. Lowrie, of Brooklyn.

CEDAR CITY, UTAH.—The Cedar Electrical Company, of Cedar Precinct, has been incorporated with a capital stock of $25,000. The incorporators are: J. H. Arthur, Lehi W. Jones, George W. Decker, Henry W. Lunt, Peter B. Fife, Thomas S. Bladen and J. G. Webster, all of Cedar Precinct.

PROPOSALS.

ELECTRIC POWER UNIT.—Bids will be received at the office of the United States Marine Corps, Depot of Supplies, Philadelphia, Pa., until April 11 for furnishing and installing one electric power unit. For further information address Cyrus S. Radford, assistant quartermaster, U. S. Marine Corps, in charge of the depot.

ELECTRICAL CONDUITS AND WIRING, AND INTERIOR LIGHTING FIXTURES.—Sealed proposals will be received at the office of the Supervising Architect, Washington, D. C., for electric conduits and wiring, and interior lighting fixtures until April 25 of a two-story building for the post office at Laurens, S. C.; until April 26 of a one-story-and-basement building for the post office at Johnstown, Pa.; until April 27 of a one-story-and-basement building for the post office at Gaffney, S. C.; until April 29 of a one-story-and-basement building for the post office at Penn Yan, N. Y.; until April 30 of a one-story-and-basement building for the post office at Somerset, Ky. Copies of drawings and specifications may be obtained from the custodians of the various sites or from the office of the Supervising Architect.

FINANCIAL NOTES.

White, Weld & Company, New York City, are offering at 93.5 to yield about 5.45 per cent the $3,000,000 first lien five-per-cent-sinking-fund bonds of the Federal Light & Traction Company recently purchased by them.

Stockholders of the Canadian General Electric Company will vote April 25 to authorize the issuance of $1,900,000 new stock at 103. For the calendar year 1911 this company earned $1,405,000 net, compared with $911,000 in 1910.

Gainsville, Fla., will receive sealed bids until 3 p. m. April 29 for $75,000 five-per-cent semi-annual sixteen and one-third-year average water works extension and street-improvement, and $50,000 five-per-cent semi-annual twenty-six two-thirds-year average electric-light-plant bonds.

Stockholders of the Mahoning & Shenango Valley Railway & Light Company voted to increase its indebtedness from $10,000,000 to $65,000,000. The company will probably build a line from Youngstown to Cleveland, Ohio. Following the meeting the directors announced that money is to be "used from time to time as needed for extensions."

Boettcher, Porter & Company, of Denver, offer seven-per-cent cumulative preferred stock of the Arkansas Valley Railway, Light & Power Company, of Colorado, at 97.5 and accrued dividend. The company is a consolidation of the Public & Suburban Traction & Lighting Company, Colorado Light & Power Company, of Canon City; La Junta Electric Company and Rocky Ford Electric Company, all located in the valley of the Arkansas River in Colorado, and serving a population of about 73,000. Stock is redeemable at 110 on sixty days' notice.

At the annual meeting of directors of the American Telephone & Telegraph Company, A. A. Marsters was elected secretary of the company, to succeed Charles Eustis Hubbard. Other officers were re-elected. President Vail of the company at the meeting said: "The American Telephone & Telegraph Company is not contemplating any financing at the present time. There has been considerable improvement in fundamental conditions, but I do not look for any great betterment in the tone of business for some time to come."

Detroit Edison's additional $1,500,000 of stock listed on the New York Stock Exchange will be reserved for the conversion of the

$1,500,000 debenture bonds which may be exchanged for stock between April 1, 1912, and April 1, 1913. Shares of stock not used for conversion will be held and disposed of by the directors as they deem advisable. The total amount of Detroit Edison stock now listed is $9,000,000 out of an authorized amount of $15,000,000. The debenture bonds convertible after April 1 were issued in 1910 and proceeds were used for new construction and improving the company's facilities.

The syndicate which is underwriting the $5,192,000 assessments on the old Allis-Chalmers common and preferred stocks, has decided to pay the $275,000 coupon on Allis-Chalmers $11,148,000 bonds which fell due January 1, and by virtue of ninety days' grace was extended to April 1. The underwriters have also paid, or arranged to pay, the approximately $2,600,000 floating debt of the old Allis-Chalmers Company.

Sufficient stock of the Havana Electric Railway and the Gas & Electric Lighting Corporation of Havana has been deposited in Havana and New York to insure the amalgamation of the two companies. The Havana Electric Railway & Power Company is the new company which will carry on the combined businesses with $30,000,000 authorized capital, half common and half preferred.

The directors of the Marconi Wireless Telegraph Company of America have called a special stockholders' meeting for April 18 for the purpose of increasing the authorized capital stock from $1,662,500 to $10,000,000, with par value of $5 a share. Of this capital some $7,000,000 will be issued in the near future to provide funds for the expansion of the system in this country. Shareholders will receive five new shares of $5 par value to replace each $25 share held, and will have the privilege of subscribing to the new stock as issued at par in proportion to the number of shares held.

It was reported in Wall Street last week that the Interborough Rapid Transit Company would shortly announce a large bond issue. Negotiations are now said to be under way between the Interborough Rapid Transit Company and a syndicate headed by J. P. Morgan & Company for the sale of a block of new first-mortgage five-per-cent bonds

Dividends.

Associated Gas & Electric Company; a quarterly preferred dividend of 1.5 per cent, payable April 15 to stock of record March 31.

Bangor Railway & Electric Company; a quarterly preferred dividend of 1.75 per cent, payable April 16 to stock of record March 21.

Bell Telephone Company of Pennsylvania; the regular quarterly dividend of 1.5 per cent, payable April 13 to stock of record April 4.

Central & South American Telegraph Company; a quarterly dividend of 1.5 per cent, payable April 16 to stock of record March 31.

Electric Utilities Corporation; a quarterly preferred dividend of 1.25 per cent, payable April 15 to stock of record March 30.

Fort Smith Light & Traction Company; a quarterly dividend of 1.75 per cent, payable April 15 to stock of record March 30.

Manchester Traction, Light & Power Company; a quarterly dividend of $2 per share, payable April 15 to stock of record April 1.

Mexican Telegraph Company; a quarterly dividend of 2.5 per cent, payable April 16 to stock of record March 31.

Mountain States Telephone & Telegraph Company; a quarterly preferred dividend of 1.75 per cent, payable April 15 to stock of record March 30.

Northern States Power Company; a quarterly preferred dividend of 1.75 per cent payable April 15 to stock of record March 30.

Ottumwa Railway & Light Company; a quarterly dividend of 1.75 per cent, payable April 15 to stock of record March 30.

Rio de Janiero Tramway, Light & Power Company; a quarterly dividend of 1.5 per cent, payable May 1 to stock of record April 10.

Springfield & Xenia Railway Company; a quarterly dividend of 1.5 per cent, payable March 30.

United Light & Railways Company; a quarterly first-preferred dividend of 1.5 per cent, and a quarterly second-preferred dividend of 0.75 per cent, both payable April 1 to stock of record March 21.

Virginia Railway & Power Company; a semi-annual common dividend of one per cent, payable April 20 to stock of record April 6.

Western States Gas & Electric Company; a quarterly preferred dividend of 1.75 per cent, payable April 15 to stock of record March 30.

Westinghouse Electric & Manufacturing Company; quarterly preferred dividend of 1.75 per cent, payable April 15; and a common dividend of one per cent, payable April 30.

Youngstown & Ohio River Railroad Company; a quarterly preferred dividend of 1.125 per cent, payable March 30.

Reports of Earnings.

NEW YORK EDISON COMPANY.

The New York Public Service Commission has issued a report covering operations of the New York Edison Company for the year ended December 31, 1911, which compares as follows:

	1911	1910
Operating revenue	$19,689,851	$18,051,106
*Operating expenses, taxes, etc.	8,287,463	10,685,241
Operating income	11,402,388	7,365,864
Other income	1,080,564	1,150,509
Total income	12,482,953	8,516,374
*Interest, rents, etc.	3,801,796	2,695,060
Net income	8,681,156	5,821,346
Dividends	3,009,204	2,897,100
Surplus	5,671,952	2,924,246
Previous surplus	20,381,839	16,930,453
Profit and loss adjustment (credit)	17,345	527,140
*Renewal and contingency reserves, etc.	2,693,647	.....
Profit and loss surplus	23,377,489	20,381,839

*In the 1911 income account subway rents ($1,189,691) are included in interest, rents, etc., and renewal and contingency reserves ($2,688,556) are included in profit and loss. These items in previous years are included in operating expenses.

CANADIAN WESTINGHOUSE.

The report of the Canadian Westinghouse Company, Ltd., for the year ended December 31, 1911, shows surplus over dividends of $460,000, against $261,000 in 1910. The income account compares as follows.

	1911	1910
Net earnings	$1,010,153	$697,393
Depreciation and reserve	200,000	130,000
Balance	$ 810,153	$567,393
Dividends	350,128	306,362
Surplus	$ 460,025	$261,031
Previous surplus	726,613	536,104
Total surplus	$1,186,638	$797,135
Written off prop. and pit.	135,794	70,522
Profit and loss surplus	$1,050,845	$726,613

AMERICAN LIGHT & TRACTION.

The report of the American Light & Traction Company for the month of February shows net earnings of $318,954, as compared with $349,966 the previous year. This decrease is said to be due to reduction in rates and increased operating costs and to the extremely cold weather. The report for February and for the first two months of the year compares as follows:

	1912	1911
February gross	$328,498	$358,908
February net	318,954	349,966
Two months' gross	726,027	760,234
Two months' net	705,314	741,550

FEDERAL LIGHT & TRACTION.

The earnings of the controlled companies of the Federal Light & Traction Company for the year ended December 31, 1911, compare as follows:

	1911	1910
Gross	$1,496,177	$1,352,450
Expenses and taxes	887,095	768,660
Net	609,082	583,790

The above earnings include for the four years the earnings of the Springfield Railway & Light Company (control acquired March 1, 1911), and Trinidad Electric Transmission Railway & Gas Company (acquired September 1, 1911).

LONDON UNDERGROUND.

The Underground Electric Railway Company, of London, England, reports receipts and expenses of associated companies for the month of February, compared as follows:

	1912	1911
Metropolitan District Railway:		
Gross receipts	£63,209	£58,860
Working expenses	31,897	28,789
Net receipts	31,312	30,071
London Electric Ry. Co.:		
Gross receipts	£65,528	£60,609
Working expenses	31,622	29,933
Net receipts	33,906	30,676
London United Tramways, Ltd.:		
Gross receipts	£22,628	£21,394
Working expenses	17,990	17,193
Net receipts	4,638	4,201

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Apr. 1.	Mar. 25.
Allis-Chalmers common (New York)	2½	⅞
Allis-Chalmers preferred (New York)	6	3
American Tel. & Tel. (New York) (ex-dividend)	146½	148⅜
General Electric (New York)	165½	166¾
Kings County Electric (New York)	129	129
Postal Telegraph and Cables common (New York)	80½	79½
Postal Telegraph and Cables preferred (New York)	69	69
Western Union (New York)	83½	84¼
Westinghouse common (New York)	76½	78½
Westinghouse preferred (New York)	122½	119¾
Edison Electric Illuminating (Boston)	298	298
Massachusetts Electric common (Boston)	21⅝	21⅞
Massachusetts Electric preferred (Boston)	96¼	96¼
New England Telephone (Boston) (ex-dividend)	*160	160
Electric Company of America (Philadelphia)	12	12
Electric Storage Battery common (Philadelphia)	54½	56
Electric Storage Battery preferred (Philadelphia)	54½	56
Philadelphia Electric (Philadelphia)	17	18
Chicago Telephone rcps. (Chicago)	*144	*144
Commonwealth Edison (Chicago)	146	145
National Carbon common (Chicago)	105	105
National Carbon preferred (Chicago)	116⅝	116½

*Last price quoted.

PERSONAL MENTION.

THEODORE B. COMSTOCK has resigned as secretary and chief engineer of the Board of Public Utilities of Los Angeles.

HAROLD W. BUCK presented a paper entitled "The Economical Combination of Steam and Water Power" at the meeting of the Schenectady Section of the American Institute of Electrical Engineers on April 2.

FRANK G. DREWRY, manager of the *Real Estate Bulletin*, of Louisville, Ky., has resigned to become manager of the new-business department of the George G. Fetter Lighting & Heating Company of that city.

CHARLES F. SCOTT, professor of electrical engineering in Yale University, received the degree of Doctor of Science from the University of Pittsburgh, at the recent exercises commemorating the 125th anniversary of that institution.

H. L. JACKMAN, manager of the Western States Gas & Electric Company, Eureka, Cal., has been appointed a member of the Eureka Industrial Commission, which is taking active steps to induce manufacturers to locate in Eureka.

IRA C. COVERT, superintendent of the electric-light, gas and steam-heating departments of the Paducah (Ky.) Light & Power Company, has resigned to become superintendent of the natural-gas plant of the Central Indiana Gas Company, at Muncie, Ind.

JOHN F. HAYFORD, dean of the college of engineering of Northwestern University, has been appointed a research associate by the Carnegie Institution of Washington and has received a grant of $6,000 in aid of his investigation of the laws of evaporation and steam flow.

W. M. SKIFF, assistant manager of the Engineering Department of the National Electric Lamp Association, read a paper on "The Development of the Incandescent Lamp" before the Engineering Society of Notre Dame University at South Bend, Ind., on March 25.

H. H. MAGDSICK, of the Engineering Department, National Electric Lamp Association, read a paper on "Gas, Gasoline, Electric Arc and Incandescent Electric Street Lighting" before the Engineering Society of the University of Wisconsin at Madison, Wis., on March 28.

HENRY S. CARHART, late professor of physics in the University of Michigan now retired on a Carnegie grant, has become connected with Throop Polytechnic Institute, in Pasadena, Cal., where he has taken up his home. He will have a special laboratory equipped with apparatus for his researches in the institute.

L. M. WEBB, formerly of the Brilliant Electric Company, has taken a position with the Department of Publicity of the National Electric Lamp Association, Cleveland, O. Mr. Webb's previous experience in the electrical-fixture and incandescent-lamp businesses will serve him in good stead in his new position, in which he has the best wishes of a large circle of friends.

LINCOLN BEERBOWER, manager of the Enid (Okla.) Electric & Gas Company, has been elected director and chairman of the Finance Committee of the Enid Chamber of Commerce. Mr. Beerbower's election carries considerable honor as the public was asked to select a candidate from a list of 28 names proposed by the organization. Mr. Beerbower received the third highest number of votes.

L. W. AUSTIN, wireless expert of the United States Navy, is now making a tour of Europe for the purpose of inspecting the wireless stations there. The trip includes the Marconi stations in Italy, the German station at Nauen, the Eiffel Tower and the station at Clifden, Ireland. Dr. Austin is seeking the best and latest ideas in wireless operation in Europe for application to the new wireless stations to be erected in Alaska, Panama, Hawaii, Guam and the Philippines by the Navy Department.

HARRY C. ADAMS, JR., formerly secretary of the R. B. Corey Company, New York City, resigned his position with that company on April 1 to enter upon new duties in the employ of the Phillips Insulated Wire Company, Pawtucket, R. I. Mr. Adams has been with the Corey Company for seven years. He started out with the old Thomson-Houston Company, at Lynn, Mass., taking what was known as the expert course, which put him through the various departments and gave him complete familiarity with the apparatus of those days. He was later connected with the New York office of the Fort Wayne Electric Works. In 1893 he became special representative of the Phillips Company and remained with them 11 years.

THOMAS DOLAN, for more than twenty years president of the United Gas Improvement Company, and one of the best known men in the country among public-utility corporations, has tendered his resignation as the active head of the company, and will for the present continue in association with the company as chairman of the board of directors. The United Gas Improvement Company controls a number of gas, electric lighting and street railways companies throughout the eastern part of the country. Mr. Dolan is eighty years old. In his early manhood he was a manufacturer of knit goods and shawls, but became interested in public utilities, and it was largely through his efforts that the Philadelphia Electric Company was formed to furnish electric lighting to the city. He aided in the formation of the Brush Electric Company, which preceded the Philadelphia Electric. He was also identified with street railway matters in this city until a few years ago. Under his management the United Gas Improvement Company expanded from a small local concern to one of the greatest in the country. Its largest investment is the Public Service Corporation of New Jersey, which lights, heats, furnishes gas and electricity, and street railways, to a chain of cities and villages from Hoboken to Woodbury.

OBITUARY.

ANTONIO PACINOTTI, professor of technological physics at the University of Pisa, Italy, died on March 24. Dr. Pacinotti was born June 17, 1841, in Pisa, and invented one of the earliest forms of dynamo. He was an honorary member of the American Institute of Electrical Engineers and a member of various scientific academies abroad.

GEORGE NEWCOMB, an X-ray specialist of Cambridge, Mass., died suddenly on March 28 of heart disease. He was 71 years old. He early learned the trade of machinist and become mechanical expert and manufacturer of engines, shafting, general machinery, incandescent and arc lamps, etc. In 1880 he was made superintendent of the Salem Electric Lighting Company. He constructed special quarters in Salem for X-ray work, and the demands upon him for this were so great that he disposed of all other business.

NEW PUBLICATIONS.

WATER POWER.—Senate Document No. 274 deals with the development and control of water power. It gives the matter presented at the hearings of the National Waterways Commission in November, 1911.

WATER POWER IN ARKANSAS.—The Geological Survey of Arkansas has issued a preliminary report on the water powers of Arkansas, dealing with the White River and some of its tributaries. This has been prepared in co-operation with the United States Geological Survey by W. N. Gladson, professor of electrical engineering in the University of Arkansas. The report may be had by sending postage (16 cents), to the State Geologist, Fayetteville, Ark.

DATES AHEAD.

Missouri Electric, Gas, Street Railway & Waterworks Association. Annual convention, Joplin, Mo., April 11-13.

American Institute of Electrical Engineers. Pacific Coast meeting, Portland, Ore., April 16-20.

American Electrochemical Society. Twenty-first general meeting, Boston, Mass., April 18-20.

Iowa Electrical Association. Annual meeting, Des Moines, April 24-25.

Iowa Street and Interurban Railway Association. Annual meeting, Des Moines, April 25-26.

Association of Iron and Steel Electrical Engineers—American Institute of Electrical Engineers. Joint meeting, Pittsburgh, Pa., April 25-27.

Southwestern Electrical and Gas Association, San Antonio, Tex., April 25-27.

American Institute of Electrical Engineers. Schenectady, N. Y., May 17.

Arkansas Association of Public Utility Operators. Annual convention, Little Rock, Ark., May 20-22.

Mississippi Electric Association. Fourth annual convention, Vicksburg, Miss., May 28-30.

National Electric Light Association. Annual convention, Seattle, Wash., June 10-14.

Minnesota Electrical Contractors' Association. Annual convention, Duluth, Minn., June 16.

Michigan Section of the National Electric Light Association. Annual convention on board the *Majestic* sailing from Port Huron, Mich., about June 21.

Society for the Promotion of Engineering Education. Annual meeting, Boston, Mass., June 25-27.

American Institute of Electrical Engineers. Annual convention, Boston, Mass., June 25-28.

National Electrical Contractors' Association. Annual meeting, Denver, Colo., July 16-19.

The 1912 Boston Electric Show. Mechanics Building, Boston, Mass., September 28-October 26.

American Electric Railway Association. Annual convention, Chicago, Ill., October 7-11.

Kansas Gas, Water, Electric Light and Street Railway Association. Annual meeting, Manhattan, Kans., October 17-19.

With the Electrical Manufacturers

Arthur S. Partridge, New Bank of Commerce Building, St. Louis, Mo., has sent out his monthly list of second-hand electrical, gas and steam machinery, of which he has a particularly large stock and assortment on hand.

The Electric Storage Battery Company, Philadelphia, Pa., has issued bulletin No. 139, which describes and illustrates the signaling and interlocking plant of the new Chicago & Northwestern Railway terminal station at Chicago, in which chloride accumulators are extensively employed.

The General Electric Company, Schenectady, N. Y., reports considerable demand for its centrifugal air compressors, 15 sets varying in size from 10 to 100 horsepower being sold recently. These are used in connection with oil-burning furnaces, pneumatic ash-conveyor systems, blowing illuminating gas, etc.

The Leeds & Northrup Company, Philadelphia, Pa., has published a bulletin describing seven representative installations of its resistance thermometers and pyrometers in Government and industrial service. Each of these equipments illustrates in marked degree some particular feature characteristic of the installation.

The Ohio Brass Company, Mansfield, O., through its western representative, R. J. Deneen, has secured an order from the Chicago, Ottawa and Peoria Railway Company for 5,500 35,000-volt insulators to be used on the transmission line west of La Salle, which is being changed from 17,000 to 35,000 volts.

The Opalux Company, 258 Broadway New York City, has published a condensed catalog of Opalux, Carrara, Camia and Glatieco glass reflectors. It gives commercial data on the standard types of these reflectors and states their advantages in effectively reflecting and diffusing the light from modern high-efficiency incandescent lamps.

Howard M. Eldred, manufacturers' agent, Milwaukee, Wis., has moved to 130 Oneida Street, where he is occupying a ground floor 21 by 50 feet, and has excellent facilities for displaying appliances and samples. He will continue to handle electric and automobile specialties in the territory comprised by Wisconsin and the Northern Peninsula of Michigan.

The Westinghouse Machine Company, East Pittsburgh, Pa., has been awarded a contract by the Brooklyn Rapid Transit Company for a 20,000-kilowatt steam turbine. This turbine will be of the familiar Westinghouse double-flow type, built along similar lines to that of the 10,000-kilowatt turbine furnished the City Electric Company, of San Francisco, about a year ago, which turbine developed what is claimed to be the highest thermodynamic efficiency of any yet installed.

The Stromberg-Carlson Telephone Manufacturing Company, Rochester, N. Y., has prepared a booklet calling attention to the many advantages of its Combination-phone. These have the transmitter and receiver mounted on a single arm. The Combination-phone weighs only 21 ounces against 65 ounces for an ordinary desk set. This lightness, along with the great convenience, makes the combination instrument highly desirable for a great many purposes.

The Stone & Webster Engineering Corporation, Boston, Mass., has published a copiously and artistically illustrated pamphlet describing the construction of the concrete dam at Hauserlake, Mont., which was designed and constructed for the United Missouri River Power Company to replace a dam that had failed early in 1908. The new dam is 490 feet long, 132 feet high at the deepest part, and 85 feet thick at the base. The normal working head is 65 feet.

The Luitwieler Pumping Engine Company, Rochester, N. Y., has issued general catalog No. 11, describing the Luitwieler system of non-pulsating pumping machinery. Central-station managers and engineers interested in pumping for cities, villages and corporate water works, private water supply, railroad tank service, manufacturing plants, and all general and special purposes for which pumps are used, should secure copies of this bulletin, which will be furnished upon request.

The Terry Steam Turbine Company, 90 West Street, New York City, has published an illustrated booklet entitled "Terry Service." It shows the wide range of uses of the thousand Terry turbines now in use in all parts of the world, driving generators, pumps, forced-draft and gas blowers, etc. It also gives the names of prominent installations and is a striking evidence of the increasing use of small steam turbines in various industries. This booklet will be sent on request to the company.

The Westinghouse Electric & Manufacturing Company, Pittsburgh, Pa., will be pleased to send to those interested in electric vehicles the March issue of "Small Motors," issued by the Company. Considerable valuable information is contained therein with reference to the operation of these vehicles and their production of revenue to the central station. A double-page picture is shown illustrating 38 pleasure and commercial vehicles equipped with Westinghouse motors.

The Pittsburgh Transformer Company, Pittsburgh, Pa., has published bulletin No. 1158, which is a reprint of an article by J. S. Jenks and W. H. Acker, entitled "Repairing High-Voltage Lines While in Service." The methods described have been in long and successful use by probably the most progressive central stations in the country. The great increase in high-voltage lines should make this pamphlet particularly valuable to central-station men, to any of whom a copy will be sent on request.

Rickard & Sloan, Incorporated, 20 Vesey street, New York, N. Y., announces the organization of an advertising company with offices in the Evening Post Building. William L. Rickard and Clifford A. Sloan are the responsible heads of the new concern, which will give particular attention to the planning and management of advertising campaigns for firms engaged in the manufacture of electrical and mechanical apparatus and accessories. The production and distribution of bulletins, catalogs, etc., will be included in the service of the new company.

The H. W. Johns-Manville Company, 100 William street, New York City, which has taken over the selling agency for Frink reflectors and lighting specialties, has published an attractively illustrated catalog (No. 408), entitled "Modern Illumination for Insurance Companies and Banks." This describes the Frink reflecting and diffusing system as applied to the illumination of counters and desks in banks and similar institutions. A number of typical installations are described. In this system the troublesome portable desk lamps are eliminated and an appropriate uniform illumination produced.

The Bristol Company, Waterbury, Conn., has issued Bulletin No. 132, devoted to Bristol's recording ammeters. This 48-page publication illustrates and describes the many direct-current and alternating-current ammeters the company manufactures. These are made with both uniform and increasing graduations. The charts are circular and of 6, 8 or 12-inch diameter; a special semi-transparent smoked chart is also made. For heavy direct currents shunted instruments are supplied and for heavy alternating currents series transformers are used with the instrument. For storage-battery and some special services plus-and-minus ammeters with the zero line in the middle of the scale are made.

The Sangamo Electric Company, Springfield, Ill., in bulletin No. 31, describes and illustrates the type H single-phase, high-torque, induction watt-hour meter for two and three-wire circuits. The descriptive term used in connection with this instrument is "Built like a watch," and the descriptive matter in this bulletin is an interesting discussion of the characteristics which go to make this term a matter of fact. One of the reasons why the Sangamo Electric Company "can and does build like a watch" is because of the co-ordination of a competent designing staff and a mechanical force trained in the manufacture of the highest-grade watches, employed by the Illinois Watch Company.

Record of Electrical Patents.

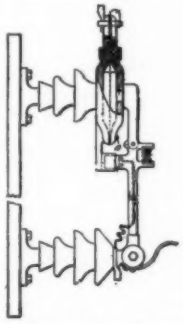
Issued by the United States Patent Office, March 26, 1912.

1,020,969. Cable Support. T. A. Dissel, Boston, Mass. A sheet-metal cable hanger formed into a helical loop with the ends hooked over the span wire.

1,020,975. Selective Signaling System. E. R. Gill, assignor to H. E. Merrell, New York, N. Y., and O. J. Hamlin, Smethport, Pa. A selector for a composite telegraph and telephone system.

1,020,976. Apparatus for Metering Conversations in Automatic Telephone Exchanges. G. Grabe, assignor to Siemens & Halske A. G. Berlin, Germany. Has a meter for each subscriber governed by relays through the testing circuits so as to record at the end of a conversation.

1,020,991. Process of Electric Welding. L. S. Lachman, New York, N. Y. Spot welding of superposed plates by applying a welding piece over the spot and then pressing the whole between current-carrying electrodes.



1,021,054.—Expulsion-Fuse Circuit-Breaker.

1,021,001. Magneto-Electric Device. H. N. Motsinger, assignor to Motsinger Device Manufacturing Co., Pendleton, Ind. The armature of a magneto is oscilated against the force of two springs.

1,021,013. Rail Joint. M. A. Stripe, Geneva, Ill. The fish plates are made of co-operating longitudinal fingers and finger-sockets electrically welded to each rail.

1,021,016. Quick-Breaking Electric-Switch Mechanism. T. W. Thomas, assignor of ninety hundredths to H. G. Wellman, Cleveland, O. A drum-type controller with cams for operating the switch levers against the force of springs.

1,021,031. Igniting Mechanism for Explosive Engines. A. Winton and H. E. Anderson, assignors to Winton Motor Carriage Co., Cleveland, O. A combined magneto and battery ignition system.

1,021,045. Secondary Electric Clock. E. A. Hummel, assignor to A. L. Haman, St. Paul, Minn. The time wire passes through a socket in a bracket into which a shank on the clock fits.

1,021,054. Expulsion-Fuse Circuit-Breaker. W. J. Lietzenmayer, assignor to Allis-Chalmers Co., and Bullock Electric Manufacturing Co. The fuse is mounted in a switch arm so that on blowing it releases the latch and forces the arm to open position.

1,021,059. Insulator. W. R. Markley, Findlay, O. A two-part insulating knob with center inclined and outer horizontal meeting faces, the latter having rough V-shaped grooves for wires not in the same horizontal plane.

1,021,061. Motor Vehicle. H. P. Maxim, assignor to Waverley Co., Indianapolis, Ind. An electric motor and a gear set are inclosed in a unit casing and connected to each driving wheel.

1,021,077. Trolley Harp. O. W. Smith Springfield, O. Has a detachable fork.

1,021,089. Submarine Contact Mine. F. Brück, Osnabrück, Germany. Is connected by a cable with an ignition circuit which is closed when the casing is collided with.

1,021,093. Lamp. J. Forsheim, New York, N. Y. A miniature incandescent lamp mounted on top of a dry cell.

1,021,097. Electrically Heated Tool. J. S. Hansen, assignor to O. A. Miller Treeing Machine Co., Portland, Me. A treeing iron with the heating element in the hollow body between two handles.

1,021,100. Combination Mail Box and Signaling Mechanism. S. S. Hopkins, Waynesboro, Va. Opening of the box rings an electric alarm.

1,021,106. Three-Wire Mercury Meter. R. C. Lanphier, assignor to Sangamo Electric Co., Springfield, Ill. Has two armatures connected each in series with an outer wire of the circuit.

1,021,132. Space Telegraphy. S. Cabot, Brookline, Mass. The receiving system is short-circuited except during the transmission of each signal.

1,021,149. Organ Swell. R. Hope-Jones, assignor to Rudolph Wurlitzer Manufacturing Co., North Tonawanda, N. Y. Has a motor for operating the shutters, and a combined indicator and controller operatively connected with the shutters and motor.

1,021,177. Switch Socket. R. B. Benjamin, assignor to Benjamin Electric Manufacturing Co., Chicago, Ill. A pull switch for a lamp socket.

1,021,179. Tapping Attachment. R. S. Blake, assignor to Benjamin Electric Manufacturing Co. A combined attachment plug and socket in which the socket casing can rotate independently of the plug or be locked to it.

1,021,187. Electric Furnace. A. E. Greene, Pueblo, Colo. Has a heating chamber with electrodes at the base of the bosh.

1,021,195. Socket for Electric Lamps. C. Knauff, Chicago, Ill. A long cylindrical casing containing compressible contact plungers has a lamp socket at one end and a plug rotatable so as to contact with the plungers at the other end.

1,021,206. Trolley Poles for Electric Traction Systems. E. M. Munro, assignor of one-half to R. E. T. Construction Co., Ltd., London, Eng. Two trolley poles side by side are geared together at their base on top of the car.

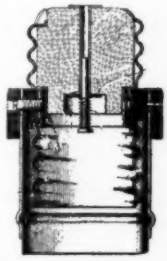
1,021,208. Rotary Snap Switch. C. D. Platt, Bridgeport, Conn. The slotted spindle carries a clip and indicating dial.

1,021,219. Igniting Apparatus for Gas Engines. E. Thomson, assignor to General Electric Co. Has automatic means for advancing the time of sparking as the speed of the engine increases.

1,021,221. Transformer. M. O. Troy, assignor to General Electric Co. A constant-current transformer carrying an iron bridging piece on the movable coil to reduce the magnetic reluctance as the load increases.

1,021,227. Automatic Motor-Starting Rheostat. P. Zimmer, assignor to General Electric Co. A solenoid moves the contact arm so as to cut resistance into the circuit and a spring gradually cuts it out.

1,021,230. Electric Heater. H. P. Ball, assignor to General Electric Co. Comprises a plate grooved to contain a resistance wire, the metal forming one side of the groove being bent over the wire.



1,021,179.—Tapping Attachment.

1,021,234. Process of Manufacturing Pure Nitric Oxide. R. M. von Berneck, M. Moest, and H. Graf, assignors to Farbwerke vorm. Meister Lucius & Brüning, Höchst-on-the-Main, Germany. Nitric and nitrous acids are subjected to electrolysis.

1,021,239. Electric Toaster. A. S. Cubitt, assignor to General Electric Co. Has a number of vertical heating elements in parallel planes separated by independently movable toasting frames.

1,021,243. Cap-Lining Fastener for Electrical Lamp Sockets. E. H. Freeman, Trenton, N. J. Has a spring locking ring beneath the edge of the lining.

1,021,250. Control System for Projectors and the Like. J. L. Hall, assignor to General Electric Co. A combined automatic and manual controller for the motor that drives the projecting lamp.

1,021,252. Bell-Ringing Transformer. S. E. Johannesen, assignor to General Electric Co. Has the secondary partly wound alongside and partly reversely over the primary.

1,021,256. Resistance. R. Miller, Jr., assignor to General Electric Co. Comprises wires of different metals arranged to slide over each other and to form a network in which the wires are relatively adjustable.

1,021,259 Impulse Transmitter. E.

Neuhold, assignor to Deutsche Telephonwerke G. M. B. H., Berlin, Germany. Includes a ratchet for operating a contact key.

1,021,266. Turbo-Generator. R. H. Rice, assignor to General Electric Co. A horizontal unit with an integral casing divided into three transverse annular heads, a generator-ventilating fan being in the middle one.

1,021,289. Single-Phase Motor. E. F. W. Alexanderson, assignor to General Electric Co. A commutator motor supplied by voltage variable independently of the current.

1,021,293. Instrument Set for Electrical Distribution Systems. V. G. Apple, assignor to Dayton Electrical Manufacturing Co., Dayton, O. A voltmeter for connection to the magneto or battery of an ignition system.

1,021,333. Regulator. F. E. Ricketts, Baltimore, Md. A regulation system for a generator field excited from several sources.

1,021,339. Indicating Push-Button. W. R. Schlage, San Francisco, Cal. Has a combined longitudinal and angular movement, the latter exposing indicating characters.

1,021,340. Means for Attaching Binding-Posts to Dry Batteries. W. A. Scott, Tacoma, Wash. The upper edge of the casing is curved out to form a support for the shank.

1,021,377. Electrical Connector. J. C. Royce, Toronto, Ont. On one block the conductors terminate in tubular sockets; on the other block they end in corresponding split pins.

1,021,408. Boat Steering and Propelling Device. J. E. Haschke, assignor to Jewel Electric Co., Chicago, Ill. An electric motor drives the propeller through a vertical shaft and bevel gearing. A jacket about the shaft is connected with a handwheel that steers the boat by changing the angular position of the propeller.

1,021,420. Shoe for Third-Rail Electric Cars. L. A. McCoubrie and C. F. Raydure, Philadelphia, Pa. For inverted third rails.

1,021,434. Portable Face Mask for Telephone Use. L. C. Stockton, assignor to Acme Utility Co., Denver, Colo. A flexible shell fitting on one end the face of the speaker and on the other end the transmitter mouthpiece.

1,021,436. Time Switch. J. Thompson, Greensburg, Pa. Is connected with the alarm arbor of an alarm clock.

1,021,453. Terminal Structure. C. W. Davis, assignor to Standard Underground Cable Co., Pittsburgh, Pa. A cable end bell consisting of a petticoated insulating casing with the wires coming out of outlets between separate petticoats.

1,021,478. Electric Induction Furnace. J. H. Reid, Newark, N. J., assignor to G. Goodwin, Ottawa, Can. Has means for rotating the heating coil in such a way as to stir the charge in the furnace.

1,021,494. Telephone System. S. C. Van Akin, Jr., Liverpool, N. Y. Includes a rotary arm carrying the transmitter and to which is pivoted the receiver.

1,021,506. Circuit-Breaker for Magnetos and the Like. R. H. Cunningham, New York, N. Y. A rotary ignition-timing device.

1,021,536. Automatic Fan. W. B. Laskey, Marblehead, Mass. Relates to means for oscillating an electric fan.

1,021,540. Electric Switch. E. T. Lockard, Cincinnati, O. Is operated by a foot treadle.

1,021,549. Fuse Case. T. E. Murray, New York, N. Y. Comprises two tubes of reticulated metal disposed one within the other.

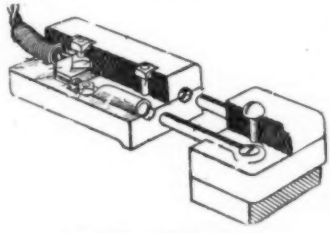
1,021,550. Electric Cutout. T. E. Murray, New York, N. Y. Permits the fuse carrier to be only partially withdrawn.

1,021,604. Circuit-Breaker, H. E. Howe, Windber, Pa. A knife switch for sectionalizing trolley wires.

1,021,637. Means for Removing Ice From Trolley Wires. J. A. Sloan, Westville, Ill., assignor of one-half to C. H. Schmidt. A vertically telescoping support is mounted on top of the car to carry a motor-driven cutting wheel.

1,021,667. Vacuum Cleaner. J. J. Duffie, San Francisco, Cal. Has an electric motor for driving a fan on each end of its shaft.

1,021,687. Insulating Rosette for Electric-Light Fixtures. N. Lang,



1,021,377.—Connector.

Vancouver, B. C., Can. Has a conical fiber guard covering the connections.

1,021,704. Electric Drier. T. B. Ray and W. Laford, New York, N. Y. Has a set of parallel resistance elements connected in series in a flat casing.

1,021,713. Electric Call System. J. W. Wilson, Rome, and W. H. Still, Utica, N. Y.; said Still assignor to said Wilson. Included in the circuit is a clock-controlled motor-driven call cylinder.

1,021,717. Combined Telephonic and Telegraphic System. E. R. Gill, assignor to H. E. Merrell, New York, N. Y., and O. J. Hamlin, Smethport, Pa. Includes selective relays for bridging any two local telephones across the line.

1,021,732. Electric Welding Machine. A. C. Taylor, assignor to National Electric Welder Co., Warren, O. A spot-welding outfit with jointed levers for bringing the electrodes together.

1,021,734. Process for Protecting Ships From Barnacles. G. Delius and C. P. Tatro, Seattle, Wash. Consists in sending a direct current to and fro at intervals through the metallic surface of the ship and the adjacent water.

1,021,746. Oil Switch. C. C. Badeau, assignor to Sears B. Condit, Jr., Boston, Mass. Includes a pair of vertically movable switch contacts.

1,021,752. Safety Appliance for Tramway Cars. J. E. Schoolfield, San Francisco, Cal. Has an electric locking means for rendering the car controller inoperative.

Patents That Have Expired.

Following is a list of electrical patents (issued by the United States Patent Office) that expired April 2, 1912.

536,608. Electrical Transformer. N. Dickerson, Fort Wayne, Ind.

536,655. Terminal Attachment for Flexible Conductors. W. L. Richards, Malden, Mass.

536,684. Self-Locking Cleat for Electric Wiring. F. O. Creager, Marseilles, Ill.

536,689. Electric Battery. H. W. Librey, Boston, Mass.

536,704. Safeguard for Cable or Electric Cars. G. Rischmuller, San Francisco, Cal.

536,705. Telephoning Apparatus. W. E. Robeson, Philadelphia, Pa.

536,763. Telephone. J. Serdinko, San Antonio, Tex.

536,764. Electric Block Signal. F. P. Snow, Lynn, Mass.

536,792. Socket for Incandescent Lamps. F. H. Soden, Chicago, Ill.

536,794. Electric Controller. G. Valley, Cleveland, O.

536,795. Switch for Street-Car Controllers. G. Valley, Cleveland, O.

536,803. Contact Finger for Electric Controllers. S. Harris, Cleveland, O.

536,809. Electrical Switchboard. F. W. Jones, New York, N. Y.

536,811. Electric Mercurial Switch or Contact Maker. H. Lemp, Lynn, Mass.

536,816. Combined Dynamo-Electric Generator and Current Director. J. F. McElroy, Albany, N. Y.

536,828. Supply System for Electric Railways. A. C. Crehore, Ithaca, N. Y.

536,855. System of Electrical Propulsion for Railway Cars L. Dion, Natick, Mass.

536,856. Shade for Incandescent-Lamp Globes. L. Dion, Natick, Mass.

536,857. Means for the Insulation of Conductors of Electricity. L. Dion, Natick, Mass.

536,871. Electric Double-Semaphore Block Signal. N. O. Goldsmith, Cincinnati, O.

536,872. Electric Block Signal. N. O. Goldsmith, Cincinnati, O.

536,914. Telephone. F. H. Brown, Chicago, Ill.

536,915. Supply System for Electric Railways. J. M. Byron, New York, N. Y.

536,918. Closed Conduit System for Electric Railways. E. D. Chaplin and L. Dion, Natick, Mass.

536,920. Telephone System. F. R. Colvin, New York, N. Y.

536,923. Safety Device for Electric Railways Having Sectional Conductors. L. Dion, Natick, Mass.

536,926. Electric Clock-Winding Mechanism. M. V. B. Ethridge, Everett, Mass., and J. H. Eastman, Boston, Mass.

536,952. Conduit Electric Railway. T. C. Hughes and A. W. Adams, St. Louis, Mo.

536,967. Trolley Support for Electric Railway Cars. E. B. W. Reichel, Charlottenburg, Germany.

536,975. Electrically Controlled Magnet and Valve for Pipe Organs. E. S. Votey and W. D. Wood, Detroit, Mich.

536,977. Electromagnet for Pipe Organs. E. S. Votey, W. B. Fleming and W. D. Wood, Detroit, Mich.

536,978. Electropneumatic Stop-Action for Pipe Organs. E. S. Votey, W. B. Fleming and W. D. Wood, Detroit, Mich.